



# United States Department of the Interior

U.S. Fish and Wildlife Service

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In reply refer to:

AESO/SE  
22410-2008-F-0486

August 26, 2011

## Memorandum

To: Chief, Wildlife and Sportfish Restoration Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico (WSFR)

From: Field Supervisor

Subject: Biological and Conference Opinion for Wildlife and Sport Fish Restoration Funding of Arizona Game and Fish Department's Statewide and Urban Fisheries Stocking Program for 2011-2021

Thank you for your request for formal consultation and conference with the Arizona Ecological Services Office (AESO) of the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). This intra-Service consultation is between the Wildlife and Sportfish Restoration Program (WSFR) and AESO. Arizona Game and Fish Department (AGFD) is the designated applicant for the grants. Your request was dated August 2, 2011, and received by us on August 3, 2011. At issue are impacts that may result from the proposed stocking of sportfish funded by the Sportfish Restoration Grants from September 1, 2011 to August 31, 2021 by AGFD in Apache, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, and Yuma counties, Arizona. The proposed action contains 130 regular stocking sites and 36 Urban Lakes or Special Urban Lakes and 16 species of nonnative fish and two species of native fish proposed to be stocked at one or more of those sites according to management directions set by AGFD as described in the proposed action.

The proposed action may affect 19 listed species (10 with designated critical habitat and four with proposed critical habitat<sup>1</sup>), one species proposed for listing as endangered with proposed critical habitat, eight candidate species, two species under consideration for candidate status and three 10j experimental populations<sup>2</sup>. Of that total, WSFR has determined that the proposed action may affect, is likely to adversely affect 14 listed species (seven with designated critical habitat and three with proposed critical habitat), four candidate species, and two species under consideration for candidate status. The proposed action may affect, but is not likely to adversely affect five listed species (three with designated critical habitat), one species proposed for listing as endangered with proposed critical habitat, four candidate species, and is not likely to

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<sup>1</sup> The critical habitat re-proposal for loach minnow and spikedace was published on October 28, 2010 and they have both designated and proposed critical habitat. The southwestern willow flycatcher revised critical habitat was published on August 15, 2011 and it has both designated and proposed critical habitat.

<sup>2</sup> For intra-Service section 7 consultations, candidate species and listed species with a 10j experimental non-essential population designation are considered as species proposed for listing under formal or informal conference.

jeopardize three 10j populations.

Appendix A contains the background information for species selection and the final list of species as included in the August 2, 2011 request for formal consultation. Tables 1 through 3 in Appendix A list all species considered in this consultation and indicates if formal consultation/conference was believed to be needed for listed species and designated critical habitat or if concurrence for not likely to adversely affect (for listed species) or not likely to adversely modify (for designated critical habitat) or not likely to jeopardize (for proposed, candidate and 10j species) or not likely to adversely modify (for proposed critical habitat) is provided. Concurrences for listed species and not likely to jeopardize rationales (where a finding of “may affect, not likely to adversely affect” was made) for candidate species and 10j species are provided in Appendix B with supporting information in Appendix E. Species in Arizona determined not to be affected by the proposed action, and the rationale for those determinations are listed in Tables 4 and 5 in Appendix A. No further analysis in this opinion is provided for species in Tables 4 and 5 of Appendix A.

This biological opinion and conference opinion (BCO) is based on information developed over the course of informal consultation, provided in the April 2011 biological assessment (BA), the March 2011 draft environmental assessment (DEA), the final proposed action provided with your request for formal consultation, telephone conversations, and other sources of information. Literature cited in this BCO is not a complete bibliography of all literature available on the species of concern, effects of stocking nonnative fish, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Because this BCO is both lengthy and complex, we are providing a paginated outline of the document and list of tables to assist in navigating through the document before the appendices.

## **Consultation History**

### **Background**

The need for a comprehensive evaluation of AGFD’s WSFR-funded sportfish stocking program was identified by WSFR and AGFD in 2007. The previous comprehensive consultation was completed in 1994. In the intervening years, additional species were listed as threatened or endangered and new stocking sites and sportfish species were proposed for stocking. These new sites or sportfish species were evaluated on a case-by-case basis by WSFR and AGFD prior to being included in the next year’s grant cycle. AGFD was developing a statewide assessment document for the comprehensive analysis. WSFR invited AESO into the process and the initial meeting was held on March 6, 2008. At that meeting, the magnitude of the project became clear, and as the consultation had to be completed by June 30, 2008 to allow WSFR grant funding to be transferred for the Arizona fiscal year beginning on July 1, 2008, the attendees evaluated options to complete the consultation in the available time frame.

The decision was to pursue two section 7 consultations; an “interim” consultation to cover July 1, 2008 through June 30, 2009 and a 10-year complete review of the stocking program to be

completed by June 30, 2010<sup>3</sup>. The “interim” consultation would be developed based on two criteria:

1. For stocked waters where there had not been any new Federal status listing actions since 1994, the existing determinations from 1994 and other case-by-case consultations would remain in place for the one-year period.
2. For stocked waters where there has been a new listing, critical habitat designation, or a significant change in the status of the species within the action area where there was potential for an adverse effect not previously evaluated, a new analysis would be completed to cover the potential for effects during the one-year period.

The “interim” consultation (22410-2008-I-0357) was completed on June 24, 2008. Species evaluated in that consultation were the Huachuca water umbel, Chiricahua leopard frog, Sonoran tiger salamander, Gila chub, headwater chub, Little Colorado Spinedace, loach minnow, spikedace, Mexican spotted owl, southwestern willow flycatcher, yellow-billed cuckoo, Yuma clapper rail, New Mexico meadow jumping mouse, Page springsnail, and Three Forks springsnail. Concurrences with “may affect, not likely to adversely affect” for all species were signed by AESO.

The complexities of developing the 10-year consultation required that WSFR, AESO and AGFD re-initiate the “interim” consultation (22410-2008-I-0357) four times. These four extensions of the “interim” consultation are described below.

- WSFR requested the first extension of the informal consultation on June 18, 2009. The proposed action (sites and stocked sportfish species) was largely the same as in 2008 with the exception of elimination of stocking at four sites and no stocking of channel catfish at two other sites. The new one-year extension reviewed the concurrences from 2008, and where appropriate, additional evaluations were done where new information or new species not considered in 2008 had been identified. New site-specific assessments for Apache trout, Gila chub, Gila topminnow, humpback chub, Little Colorado Spinedace, loach minnow, roundtail chub, spikedace, Arizona tree frog (Huachuca DPS), Chiricahua leopard frog, Sonoran tiger salamander, northern Mexican garter snake, and bald eagle were completed. AESO provided concurrences for all assessments for the additional one-year on June 22, 2009 to cover the period until June 30, 2010.
- WSFR requested a second extension of the informal consultation on June 18, 2010. There were no changes to species status; however, new site-specific analyses for New Mexico meadow jumping mouse and spikedace were completed. AESO provided concurrences for all assessments on June 18, 2010, for the period July 1, 2010 to October 31, 2010.
- WSFR requested a third extension of the informal consultation on October 15, 2010. There were no changes to species status; however, revised analyses for bald eagle and Northern Mexican gartersnake were completed, and a new analysis for the roundtail chub was completed. AESO provided concurrences for all assessments on October 25, 2010,

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<sup>3</sup> Although there are three separate consultations (22410-2008-I-0357, 22410-2008-F-0486, and 22410-2010-F-0279) involved here, the connection between them is such that the consultation history must describe events related to each in order to present a clear picture of how the consultation proceeded.

for the period of November 1, 2010 to March 31, 2011.

- WSFR provided a fourth extension of informal consultation to cover the period from April 1 to August 31, 2011, to allow time for the completion of the National Environmental Policy Act (NEPA) process. The DEA was released for public comment on March 10, 2011.

For the 10-year consultation (this consultation; 22410-2008-F-0486) the entire WSFR grant-funded stocking program for AGFD would involve a complete review and analysis of the stocking program including any new species and/or new proposed sites as well as the identification and inclusion of past, on-going, and proposed future mitigation and/or conservation efforts for listed, proposed, or candidate species. This consultation was initiated with a request for a species list from WSFR dated August 19, 2008. AESO responded with a species list on September 9, 2008. AGFD was designated as an applicant on August 21, 2008, which enabled their personnel to work with the FWS to complete the consultation.

With the delays resulting from the complexity of completing the 10-year consultation, WSFR requested a new species list on October 7, 2009. AESO provided a new list on October 26, 2009. The specifics of changes between the September 9, 2008, and October 26, 2009 species lists are discussed in Appendix A. Work on the analyses continued through the rest of 2009 and 2010.

On March 5, 2010, AESO learned that AGFD had stocked rainbow trout into Peña Blanca Lake. The June 22, 2009, second “interim” consultation had included a concurrence for stocking rainbow trout into Peña Blanca Lake based on the unlikelihood that Chiricahua leopard frogs would be present at the lake during the winter rainbow trout stocking period. However, Chiricahua leopard frogs were found at the lake in September and October of 2009. AGFD requested the ability to further stock the lake with rainbow trout in March 2010. WSFR requested formal consultation with AESO on March 9, 2010. AESO provided a non-jeopardy biological opinion under consultation number 22410-2010-F-0279 to WSFR on March 16, 2010, to allow the one additional stocking of rainbow trout into Peña Blanca Lake in 2010. Because AGFD wished to stock rainbow trout into Peña Blanca Lake from November 1, 2010 through March 31, 2011, the formal consultation was reinitiated to extend the covered stocking period through March 31, 2011. The reinitiated biological opinion was signed on October 27, 2010. Future stockings of rainbow trout into Peña Blanca Lake will be covered by the 10-year consultation (this consultation).

Stocking of warmwater sportfish species into Peña Blanca Lake is not part of this consultation. A separate consultation (22410-2010-F-0330) for the stocking of largemouth bass, channel catfish, redear sunfish, bluegill, and black crappie into the lake for a three-year period (2011-2013) was completed on May 10, 2011 with the issuance of a BO. Any future stocking of warmwater sportfish species into the lake beyond 2013 will require additional section 7 consultation.

### Important milestones

Development of the materials needed for this consultation was complex task that continued over many months. Discussions on process, section 7 requirements, and information development

were lengthy and required numerous iterations to create the documents for the BA and effects analyses. Milestones for the April, 2011 BA and effects analyses are listed below:

- August 18-19, 2009: AESO, WSFR, and AGFD met to develop process for completion of watershed chapters (these chapters contain the information on stocking sites, species to be stocked, connectivity of the watershed, extant aquatic community, and the listed and candidate species that may be affected) that will be the focus of the BA: AGFD developed the chapters and WSFR reviewed and provided comments back to AGFD. Once chapters were accepted by WSFR, they were sent to AESO for review. Comments from AESO were integrated and the chapters finalized.
- November 17, 2009: AESO provided draft of a Fish Interactions document for review by WSFR and AGFD. AGFD provided a revised draft for AESO and WSFR comment on February 16, 2010, and comments were provided. AGFD made further revisions and released the document to WSFR and AESO on May 27, 2010.
- December 2009-May 2010: effects analysis documents drafted cooperatively by AGFD, WSFR, and AESO to assist in effect evaluations for Apache trout, bald eagle, Chiricahua leopard frog, Colorado pikeminnow (10j), Mexican spotted owl, narrow-headed gartersnake, northern leopard frog, Northern Mexican gartersnake, razorback sucker, southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail.
- May 18, 2010: Watershed chapters began to become available for AESO or Arizona Fishery Resources Office (AzFRO) species-lead biologists to review for effects to their species, define take, and identify conservation measures. Chapter comments and information on species effects returned to AESO lead consultation biologist for compilation.
- June 24, 2010: AESO, WSFR, and AGFD meet to discuss findings from species leads and identify conservation options. Fourteen listed species and five candidates or potential candidates were determined to be adversely affected by the proposed action and four listed species and six candidate or 10j populations were determined to be affected but not adversely affected by the proposed action. These determinations were made based on direct effects from stocking or angler access. Determinations for effects from illegal movement of fish and disease vectors remained to be finalized for two listed species. Discussions on the need for WSFR to request a new species list (the existing list dates from October 26, 2009) were held and it was determined that the June 24th discussion was sufficient to validate a list of species to be considered.
- December 2010 through January 2011: AESO, WSFR, and AGFD developed the Conservation and Mitigation Program (Program) that would be part of the proposed action. The Program was designed to provide conservation actions for ESA species and mitigation for EA species to both address effects of the proposed action and improve the baseline conditions for native aquatic species considered in the environmental compliance.
- March 10, 2011: the draft EA was released for public comment. Subsequently, the BA and the preliminary draft BCO were also released to the public. Since the draft EA relied heavily on the findings of the draft BCO, the public had requested the draft BCO for examination, but not for public comment. Any comments received on the draft EA that referenced the draft BCO were examined for new technical or scientific information that was relevant to finalizing the BCO.

- WSFR initiated formal consultation on August 2, 2011. With the request, WSFR included the final proposed action for the consultation (including the Conservation and Mitigation Program). This BCO reflects the changes made in the final proposed action after the release of the draft EA and the draft BCO.
- The final draft BCO was provided to WSFR on August 19, 2011. Comments from WSFR and AGFD were received on August 25, 2011 and incorporated into this final BCO.

## **BIOLOGICAL AND CONFERENCE OPINION**

### **DESCRIPTION OF THE PROPOSED ACTION**

The proposed action is the funding of the AGFD sportfish stocking program through the AZ F-24 D Urban Fishing Stocking Grant and AZ F-23-M Fish Hatcheries and Stocking Grant. The period of coverage is 10 years. The WSFR grant provides funding for AGFD to raise sportfish for stocking, purchase of sportfish raised by entities other than AGFD, and deliver sportfish to the stocking sites. The proposed action involves 166 stocking sites in the state of Arizona (including 36 sites in the Urban Fishing Program or Special Urban Waters), and 18 species of native and nonnative sportfish to be stocked at one or more of those sites. The proposed action is fully described in the April, 2011, BA, the March, 2011 draft EA, and materials provided to AESO with the request for formal consultation. The list of stocking sites and the sportfish species proposed for stocking is in Appendix C of this BCO. The proposed action for this consultation does not include hatchery operations and maintenance activities that were described in the EA.

During the course of the consultation, AGFD modified the proposed action to reduce the potential for adverse effects to the consultation species. Alterations to the list of stocking sites and species proposed for some sites was an ongoing process up to the time of initiation of formal consultation with the final proposed action included with the August 2, 2011 request for formal consultation. Significantly, over the first three years covered by this consultation, AGFD proposes to transition to raise and stock only triploid rainbow trout from AGFD hatcheries and prioritize stocking sites to receive these triploid fish. Other modifications to the proposed action to reduce the potential for adverse effects to native aquatic species includes the elimination of historical practices of moving sportfish from one drainage to another as a management technique as this could result in transport of diseases or parasites from one drainage to another and development and use of a more rigorous site-specific Hazard Analysis and Critical Control Point (HACCP) protocol for stocking warmwater sportfish at sensitive native species habitats to reduce the opportunity for inadvertent transfer of unwanted aquatic species or disease.

AGFD, WSFR and AESO developed a Conservation and Mitigation Program (CAMP) to be implemented as part of the proposed action. This program will be funded at an average of \$500,000.00 a year for the 10-year period covered by this consultation. While all native aquatic or riparian species considered in the consultation will benefit from actions implemented under the program, the eight focus species (those potentially experiencing a high relative impact from the proposed action) will be targeted for the majority of the conservation actions. The priority species are:

- Chiricahua leopard frog
- Northern leopard frog
- Headwater chub
- Loach minnow
- Roundtail chub
- Narrow-headed gartersnake
- Northern Mexican gartersnake
- New Mexico meadow jumping mouse

The program is fully described in the final EA and is included in Appendix C as part of the proposed action. The CAMP also lists as required actions any terms and conditions that implement reasonable and prudent measures from Incidental Take Statements included in this BCO. Briefly, the program will use a suite of tools to provide on-the-ground conservation benefits to the native aquatic species and, where appropriate, to riparian or terrestrial species indirectly affected by anglers. Tools available for the program include, but are not limited to:

- Population inventory: systemic sampling of areas to assess species presence;
- Population or community monitoring: systematic sampling of populations to determine status and/or trend over time;
- Directed research: activities that focus on specific issues relating to species interactions to define management options for future implementation;
- Address stressors<sup>4</sup>: Identify and assess current and future key stressors to native aquatic wildlife populations that are, or may be, controlling or predominant contributing force driving the population or species declines. Collaborate with stakeholders to address, remove, or mitigate these key stressors;
- Reintroduction and augmentation: reintroduction or augmentation into historical range is a frequently used tool to recover species. Reintroductions are often coupled with construction of exclusion barriers and removal or suppression of nonnative species. Reintroductions and augmentations are implemented consistent with accepted guidelines such as George et al. (2009).
- Information, education, and outreach activities: includes signs, publications, promotions, and marketing activities; and
- Guidelines: assessing, evaluating, and proposing modifications of guidelines or regulations that can protect or minimize threats to native aquatic species.

In addition to measures that would benefit several species, some species have individual measures that address specific issues of concern. Relevant measures from the CAMP are included in each of the species-specific analyses. Some measures in the CAMP are mandatory under the ESA and NEPA, while others, particularly implementation of recovery plan or conservation plan actions, will be accomplished if funding is available.

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<sup>4</sup> Implementation of actions on the landscape may result in stressors that affect species or their habitat. Such actions can include livestock grazing, road construction, or introduction of new species. Examples of stressors are habitat loss or degradation, predation, competition, or direct disturbance of individuals of a species.

Each year, an annual work plan will be developed by AGFD with input from and coordination with AESO and WSFR to identify specific actions to be taken for consultation species in that year. The annual report of the previous year's activities and the three interim reviews will be the vehicle to assess progress toward meeting the mandatory conservation measures.

## **ORGANIZATION OF THE BCO**

This BCO contains evaluations of the effects of the proposed action on two different scales; the individual species site-specific and area-wide. These scales reflect the types of effects under consideration in the evaluations, and are discussed separately in the document. The site specific scale evaluations are presented first in this BCO, with the area-wide evaluation presented last. The final conclusion for all species will combine the analyses from the two scales.

### **INDIVIDUAL SPECIES SITE-SPECIFIC SCALE**

The individual species site-specific scale evaluates the effects attributable to the proposed action of stocking sportfish into the stocking sites relative to the presence of consultation species at or near those sites and how that stocking affects those species, and includes effects to species from anglers accessing the stocking sites. For stocking sites where the proposed action is the continuation of the past stocking program, the analysis considers that the direct, indirect, and inter-dependent/inter-related effects occur in the Environmental Baseline and are carried forward at the same level into the 10-year future covered by this consultation. Cumulative effects considered in these analyses are focused on the non-Federal actions specific to the action area around the stocking site.

The action area for this scale includes the proposed sportfish stocking sites and the hydrologically connected areas surrounding them where stocked sportfish or their progeny may be found after the stocking event. The hydrologically connected areas for each stocking site were determined based on a number of factors including the presence of perennial water, connectivity between waters during normal hydrological cycles, and the presence of barriers or obstacles that impeded or prevented movement by live sportfish from the stocking site. Some stocking sites were determined to be closed, and the action area for those sites did not extend beyond the stocking site and the adjacent area anglers use to access the stocking site.

Consultation species evaluated under the individual species site-specific scale are those where direct and/or indirect effects from the stocking actions are anticipated. Those effects, and any conservation measures included in the proposed action, are analyzed on those effects, the status of the species, the environmental baseline and the cumulative effects.

### **AREA-WIDE SCALE**

The area-wide scale has a wider perspective and focuses on the indirect, interrelated, and interdependent effects of the proposed action that are more effectively addressed at this wider scale and looks at three general areas; two of which are concerned with the introduction or facilitated movement of nonnative fish, amphibians, and invertebrates; invasive aquatic species; and parasites or diseases (hereinafter referred to as unwanted aquatic organisms) to waters in



Arizona.

The first is the inadvertent transport of unwanted aquatic organisms via stocking actions that are part of the proposed action, persons legally engaged in supporting sportfishing in Arizona (for example, bait dealers) or by anglers pursuing stocked sportfish. An example of inadvertent transport is a load of sportfish to be stocked containing veligers of nonnative mussels that could contaminate the stocking site and result in adverse effects to the consultation species; or where veligers are transported via bilge water in private boats from one site to another. The introduction of Rio Grande leopard frog to southern Arizona through individuals of the species transported in a load of sportfish to a stocking site is an example of this situation occurring.

The second is the illegal introduction or transport of unwanted aquatic organisms through deliberate actions of anglers or other persons for purposes of creating private bait sources, creating new fishing opportunities outside of legal stocking actions, or other violations of laws and regulations regarding introduction and transport of aquatic species.

Not all illegal or inadvertent movement of unwanted aquatic organisms is attributable to the current proposed action as an indirect action; the illegal and inadvertent movement of unwanted aquatic organisms has gone on for decades and while originally these activities were directly attributable to nonnative fish stocking of the time and should be considered an effect of those actions, the spread of unwanted aquatic organisms during the period covered by this BCO is more complex. All illegal or inadvertent movements of unwanted aquatic organisms (either those related to past stocking events that are not part of the proposed action and those that are being continued under the proposed action) that occurred prior to the date of this BCO are part of the Environmental Baseline for this consultation. A subset of the future illegal or inadvertent movement of nonnative aquatic organisms that is related to the continuing stocking actions in the proposed action is considered under the effects of the action as an interdependent action that will continue to occur at the same rate as assumed in the Environmental Baseline. For new stocking sites or species included in the proposed action, they create an additional opportunity for illegal or inadvertent transport that is an additive effect to that from the continuing stocking actions and these are considered as new indirect effects. The remainder of the illegal/inadvertent transport is not associated with the proposed action, is part of the Environmental Baseline, and continues into the future as cumulative effects. Conservation measures identified to address effects from these actions are considered in this analysis.

The third area is the physical effects to aquatic or riparian habitats from anglers pursuing stocked sportfish at stocking sites. These include degradation of physical habitat features, and the disturbance, injury, or death of individuals of affected species (both aquatic and terrestrial). For the terrestrial species, this evaluation is included in greater detail in the individual species site-specific analyses, because it is the only effect of the action on those species. Because there is no measure of these effects, and other recreationists also contribute to these effects, it is not feasible to measure the magnitude of these effects across the landscape.

## SPECIES INTERACTION ANALYSES

The literature on the effects of nonnative invertebrates, fish, and amphibians on the native

aquatic species that are considered in this consultation is extensive, with published and gray literature sources that explore the wide range of potential impacts on these native aquatic species from these nonnative species from both a general and a species-specific focus. Previous biological opinions prepared by AESO on the Central Arizona Project (USFWS 1994a, 2001a, 2002a, 2008a) compiled a considerable amount of this information as background material for those analyses on the potential effects of introduction of new nonnative species to the Gila River Basin via the new canal system. We incorporate these documents by reference. In addition, more recent listing packages contain extensive literature reviews of the potential effects on the native aquatic species and are incorporated into the individual species site-specific sections by reference. Further, recent 12-month findings for headwater chub (USFWS 2006a), Northern Mexican gartersnake (USFWS 2008b), and roundtail chub (USFWS 2009a) contain detailed discussions of the effects of nonnative species on these taxa that are also incorporated by reference. Additional discussions of effects of nonnative species on native aquatic species are found in Recovery Plans and various other consultation or conservation documents. Where appropriate, these documents will be cited under the appropriate species discussion.

To streamline the discussions of potential effects to consultation species from the sportfish species proposed for stocking under the proposed action, Appendix D contains information from the BA that summarize the potential effects of nonnative species proposed for stocking on native fish and native amphibians and reptiles. This information, plus the documents discussed in the preceding paragraph and those mentioned in the species' analyses are the basis for the individual species site-specific analyses and the broader analysis under the area-wide scale. Reliance on these documents to provide the larger picture of species interactions and effects will enable the species-specific discussions to be shorter and focus on the potential for the effects to occur and, since most information in Appendix D relates to more than one consultation species, less repetitive. The information in Appendix D should be considered as included in the relevant species assessments provided later in this BCO.

## **INDIVIDUAL SPECIES SITE-SPECIFIC SCALE ANALYSES**

Each listed, proposed, and candidate species for which AESO has determined the proposed action "may affect, is likely to adversely affect" is addressed in a complete and independent section through defining conservation recommendations. The analyses, conclusions, and incidental take statements are based on the effects of the proposed action and any species-specific conservation measures included in the proposed action. Because for any one species, there may be several analyses (based on where populations of the species may be affected by the proposed stocking actions), repetitive language on the meaning of types of effects and other duplicative text is contained only in the first of the analyses for each species.

### *Listed species*

#### **Apache trout (*Onchorhynchus apache*)**

### **DESCRIPTION OF THE PROPOSED ACTION**

Apache trout are proposed for stocking in 15 sites in the Black River drainage and Little

Colorado River drainage. Table 1 shows the sites and co-stocked species. Apache trout may also be affected by stocking of other sportfish species in Little Ortega Lake, White Mountain Reservoir, and Show Low Creek. New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 1: Stocking sites, sportfish species proposed for stocking, and potentially affected Apache trout recovery populations.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking<sup>5</sup></b> | <b>Situations involved<sup>6</sup></b> | <b>Recovery stream affected</b> |
|------------------------------|--------------------------------------------------|----------------------------------------|---------------------------------|
| <i>LCR above Lyman</i>       |                                                  |                                        |                                 |
| Becker Lake                  | ONAP, ONMY, THAR*                                | 1, 5                                   | none                            |
| <i>West Fork LCR</i>         |                                                  |                                        |                                 |
| White Mountain Reservoir     | ONMY                                             | 3                                      | South Fork LCR                  |
| Mexican Hay Lake             | ONAP                                             | 3                                      | South Fork LCR                  |
| Lee Valley Lake              | ONAP, THAR                                       | 1, 2, 3                                | Lee Valley Creek                |
| Bunch Reservoir              | ONAP*, ONMY                                      | 1, 2, 3, 5                             | South Fork LCR<br>West Fork LCR |
| River Reservoir              | ONAP*, ONMY                                      | 1, 2, 3, 5                             | South Fork LCR<br>West Fork LCR |
| Tunnel Reservoir             | ONAP*, ONMY                                      | 1, 2, 3, 5                             | South Fork LCR<br>West Fork LCR |
| WF LCR Greer                 | ONAP, ONMY                                       | 1, 2, 3, 5                             | South Fork LCR<br>West Fork LCR |
| WF LCR Sheep's Crossing      | ONAP                                             | 2, 4                                   | West Fork LCR                   |
| <i>Upper LCR</i>             |                                                  |                                        |                                 |
| Ortega Lake                  | ICPU                                             | 2, 3                                   | Mineral Creek                   |
| <i>White Mountain</i>        |                                                  |                                        |                                 |
| Silver Creek                 | ONAP, ONMY                                       | 1, 5                                   | none                            |
| <i>Schoens Complex</i>       |                                                  |                                        |                                 |
| Show Low Lake                | ONAP*, ONMY, SAFO*, ONCL*, ICPU, LEMA*           | 1, 5                                   | none                            |
| Show Low Creek*              | ONMY                                             | 5                                      | none                            |
| Fools Hollow Lake            | ONAP*, ONMY, SAFO*, ONCL*, ICPU, LEMA*           | 1, 5                                   | none                            |
| <i>Black River</i>           |                                                  |                                        |                                 |
| Ackre Lake                   | ONAP, THAR                                       | 1, 2, 3, 5                             | Fish Creek                      |
| Big Lake                     | ONAP, ONMY, SAFO,                                | 1, 3, 5                                | West Fork Black                 |

<sup>5</sup> See Appendix F for key to abbreviations for names of stocked sportfish species

<sup>6</sup> Descriptions of situations are listed in the effects of the action section and in Appendix D.

|                       |             |         |                               |
|-----------------------|-------------|---------|-------------------------------|
|                       | ONCL        |         | River streams                 |
| East Fork Black River | ONAP, ONMY* | 1, 3, 5 | West Fork Black River streams |
| West Fork Black River | ONAP        | 2, 3, 5 | West Fork Black River streams |

#### Conservation measures included in the proposed action

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population that may have effects to stocked or recovery populations of Apache trout.

AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

The AGFD shall continue to work with partners to annually evaluate barrier conditions on Mineral Creek, South Fork Little Colorado River, and West Fork Little Colorado River, survey for nonnative fish in recovery streams following the established schedule, and repair barriers in these three streams as needed as part of the proposed action. Funds expected to implement these activities do not contribute to meeting the average annual funding requirement of \$500,000.

#### STATUS OF THE SPECIES (rangewide and/or recovery unit)

##### *Listing*

The Apache trout was listed as an endangered species under the 1966 Federal Endangered Species Preservation Act. It was downlisted to threatened in 1975 after re-evaluation of its status in light of recovery actions taken by the White Mountain Apache Tribe (WMAT), AGFD, FWS, and other partners. The downlisting contained a 4(d) rule allowing the WMAT and AGFD to set up recreational fisheries for the Apache trout. Angler take of Apache trout is not considered incidental take if done in accordance with relevant Tribal or State law (USFWS 2009b).

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Apache trout. This information was taken from the Apache Trout Recovery Plan (USFWS 2009b) and recent 5-year review (USFWS 2010a). Information in these documents is incorporated by reference.

##### Life history

Apache trout are opportunistic feeders that eat a variety of aquatic and terrestrial invertebrates, the utilization of which can vary by season and size of the fish. They forage in the water column on drifting invertebrates and may also forage on the substrate, particularly in lakes. While less piscivorous than other trout, they may take small fish. They feed at higher light intensities than brown trout, which may be a factor in the amount of competition between them for foraging spots.

Apache trout spawn in March through mid-June, with redds constructed at the downstream ends of pools on a variety of substrates. Maturation may take three years, with larger and older fish producing more eggs. A single female may deposit eggs in more than one redd during the spawning season.

#### Habitat use

Apache trout spend a considerable portion of the day feeding and residing in portions of pools exposed to direct sunlight. In the absence of competition, Apache trout select pools with slower current and abundant cover. Apache trout also appear to select pools with greater width, lower width to depth ratios, and more eddy flows.

#### Current distribution

The Apache trout recovery populations occupy 119 miles of streams in 29 populations (both relict and replicated) on the WMAT and ASNF in the Salt (Black and White Rivers) and Little Colorado River drainages. Additional streams and lakes are stocked with Apache trout that are surplus to the recovery efforts to create recreational fisheries. In addition to populations within the currently identified historical range, Apache trout are in North Canyon Creek, a tributary to the Colorado River in the Grand Canyon, and in several locations in the Pinaleno Mountains (Ash, Big, Grant, and Marijilda creeks), and tributaries to the Blue River (Coleman, KP and Grant creeks). The Pinaleno Mountains and Blue River populations are scheduled to be removed as these areas are now considered historical habitat for the Gila trout, not the Apache trout.

Recreational fisheries for Apache trout are managed on the WMAT at several locations and on the ASNF as indicated in the description of the proposed action above.

#### Threats

Threats to the Apache trout include land management and land uses that degrade the watersheds or stream systems, and the presence of nonnative aquatic organisms, particularly fishes. Nonnative trout are of particular concern for the Apache trout, as rainbow trout can hybridize with them, and all introduced trouts may compete for food and space and there is the potential for predation on small Apache trout by the nonnative species.

#### Conservation actions

A full discussion of the various conservation actions that have been taken for the Apache trout is included in the recovery plan (USFWS 2009b). Funding for conservation actions is provided by

AGFD, USFWS, ASNF, and WMAT. As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the Apache trout recovery plan. Apache trout are also a keystone species for the National Fish and Wildlife Federation, which is providing additional funding for recovery actions for a 10-year period. Actions include construction and maintenance of barriers on recovery streams to prevent nonnative species from invading the streams, chemical treatments to eliminate nonnative fishes from recovery streams, restocking of recovery streams with one of the relict lineages or with hatchery stock, and land management actions to improve watershed conditions. Until the recent Wallow Fire, overall, population trends were upward, with additional recovery populations in development. Fortunately, the Wallow Fire only affected one of the historical populations, and of the recovery streams in Arizona (streams on the WMAT were not affected), most of the affected populations were either hybrids scheduled to be replaced with pure populations or were small and in streams with compromised barriers also due for remedial attention (Lopez 2011). Continuing implementation of recovery actions to regain any ground lost is anticipated.

#### *Previous consultations*

Section 7 consultations on Apache trout include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Apache trout may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

The action area is a subset of the specie's rangewide distribution that includes only lands on the ASNF in the Little Colorado River and Black River. Most recovery streams in these watersheds will not be directly affected by the proposed action, and will not be mentioned in the analyses.

#### **A. Status of the species within the action area**

The action area contains one relict population of Apache trout in the Black River drainage, and four recovery streams or sets of streams in the Black River drainage, and six recovery streams or sets of streams in the Little Colorado River drainage. There are also four streams on the ASNF with Apache trout X rainbow trout hybrids. Ongoing recovery efforts include work to maintain

barriers, construct new barriers, and renovate additional streams.

## **B. Factors affecting the species' environment within the action area**

Land management actions are being addressed under Forest land management plans but historical practices continue to have effects to watersheds that influence stream conditions. Drought has played a role in reduced streamflows and higher temperatures that affect the amount and quality of the habitat. Apache trout recovery streams are generally the small, headwater streams that are limited in extent even during wet periods. Wildfire is also a concern for stream health, and post-fire ash flows can kill fish far beyond the extent of the fire. The adverse effects of wildfires were realized in 2011 after the Wallow Fire when one natural and eight recovery populations were affected by this wildfire. Apache trout populations established for sportfishing purposes in the Little Colorado and Black River drainages were also affected. Post-fire monitoring and protection actions are ongoing by the Apache-Sitgreaves National Forest (ASNF). Populations were affected to some degree by the fire itself and post-fire runoff that introduced ash and sediment to the streams (Lopez 2011). We anticipate actions to restore Apache trout to the recovery populations, and continuing stocking under the proposed action to restore those non-recovery populations where sportfishing is allowed.

Nonnative fish, including trouts, are established in the streams and lakes of the action area. Barriers on recovery streams are not always perfectly efficient at keeping nonnative fish out of the recovery reach. Barriers require continual monitoring and maintenance, and, at any one time, one or more barriers may not be properly functioning. In those cases, nonnative fish from downstream may access the recovery reach and necessitate additional mechanical or chemical renovation of the stream to restore it for Apache trout.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the Apache trout are in the recovery plan (USFWS 2009b). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition and hybridization by the stocked sportfish species on Apache trout.

When stocked with nonnative trout species or into sites where self-sustaining populations of nonnative trouts are present, Apache trout are subject to competition for space and food. This may be more acute in streams where pool habitats (preferred habitat for all trout species) are

limited, and where prime foraging locations may be dominated by larger trouts, particularly brown trout. Habitat and the forage base is not as limiting in lakes, except if the lake is stocked beyond its carrying capacity and stocked trout are not removed by angling. Stocked trout may also persist longer in lakes, although generally do not spawn due to a lack of suitable spawning habitat. Apache trout in streams or lakes that have spawning habitat available can hybridize with rainbow trout. In situations that are not recovery streams, this hybridization is not a concern for the recovery of the Apache trout.

Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Those recovery stocking actions are not part of the proposed action. Apache trout stocked from the hatcheries for the specific purpose of providing fishing opportunities are part of the proposed action. Apache trout stocked for recreational purposes as part of the proposed action are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

The effects analysis for the Apache trout is complicated by several factors, among them the 4(d) rule that provides for the development of the recreational fishery. Evaluation of potential impacts to Apache trout must include these factors. These scenarios relate only to effects to Apache trout; effects of stocking Apache trout on other listed or candidate species will be addressed in the analysis of effects for those species elsewhere in this BCO. Each stocking site has a combination of these factors to consider in the effects analysis (Table 1).

1. *Impacts from sport fish species co-stocked with Apache trout in non-recovery areas for the intent of providing angling opportunity.*

In 12 cases, Apache trout would always or sometimes be stocked along with Arctic grayling or other nonnative trouts, and in two of those cases, with nonnative warmwater fish species. As described in Appendix D, impacts to stocked Apache trout from co-stocked sport fish species may include predation or competition with all species (at various levels), and/or hybridization with stocked rainbow trout. Because the Apache trout stocked into these areas are not part of the recovery populations, they are not expected to persist to establish populations. The effects of additional stocked species on Apache trout are insignificant.

2. *Impacts from stocked sport fish species to recovery Apache trout that escape from recovery areas above barriers.*

In nine cases, stocking sites are above (one) or below (eight) Apache trout recovery streams. If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, the “recovery” fish would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery since they were no longer in the recovery stream. Impacts to these



individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas (see #1 above).

3. *Impacts from stocked sport fish species to recovery Apache trout if those stocked species move above a failed barrier or into recovery reaches.*

Indirect effects to recovery Apache trout may occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. This situation exists at 12 sites, of which three are of concern. As documented in the Recovery Plan (USFWS 2009b), barrier failure is not uncommon, with maintenance and repairs needed on an ongoing basis. For example, barriers on the West Fork Little Colorado River and Lee Valley Creek, are not properly functioning and need repair (USFWS 2009b) and this is supported by a request from the Forest Service earlier in 2010 for repairs and maintenance of 11 fish barriers. The proposed action described the following barriers associated with stocking sites as NOT EFFECTIVE (which do not necessarily mean the barrier is failing): EFLCR (Lower), WFLCR (upper/lower), SFLCR (upper/lower), and Hayground Creek. Fish Creek was described as having sufficient height but with some risk. The WFLCR Upper barrier was described as having potential risk because of Gabion construction and the Left Wall needs to be extended. All barriers are proposed for repair with project completion in 2018.

Should barrier failure occur, the Forest Service and AGFD would attempt to repair the barrier and if necessary retreat the reach to remove nonnative fish. With issues of funding, completion of compliance activities for the repair and renovation, this period may last for a year or more. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with recovery populations of Apache trout could occur.

In one case, Ackre Lake, movement of stocked Arctic grayling into the Fish Creek recovery stream is very likely since the lake is on the headwaters and spills into the creek. Apache trout and Arctic grayling are stocked together at this site and in Lee Valley Creek. Predation, competition, or hybridization is not an issue between these two species, and Arctic grayling do not persist in stream environments in Arizona. No effects are anticipated for these two sites if Arctic grayling do enter the recovery stream.

This is also an issue for two stocking sites where only Apache trout are stocked below recovery streams or where connectivity between the recovery stream and the stocking site does not exist (so that stocked fish could not access the recovery stream). As in #2, all Apache trout have the same Federal standing as a threatened species, so the intermingling of recovery and recreation fish is not a concern except as it may affect management of the relict lineages. Recreational stockings at Mexican Hay Lake are not of the same lineage as the Apache trout in the South Fork Little Colorado River and connectivity between the two areas is not desirable.

4. *Impacts from Apache trout stocked into recovery Apache trout populations with the intent that the entire population be fishable by the public.*

This only occurs in one case, the West Fork Little Colorado River at Sheeps Crossing. A portion of the recovery stream is a popular recreation area and is stocked with Apache trout. These are

of the same lineage as the founder population. The stocked fish and the recovery fish intermingle in this area, and as noted under #2, both may be legally taken by anglers. This recovery population is designated open to angling under the special 4(d) rule. Once stocked, Apache trout will be considered part of the recovery population. The Department would stock hatchery reared apache trout into the recovery population at densities expected to maintain angler satisfaction while minimizing impacts to the population as a whole. Some density dependent competition may occur in the stocking reach however not throughout the entire recovery reach since stocking only occurs at the lower end of the reach where angler access is possible. Additionally, the heavy recreational use (which includes anglers, hikers, and other recreationists) of the stocking reach likely has degraded the habitat through effects to bankside vegetation which increases sedimentation, water quality issues from persons in the water, or spills of materials, and other disturbances. The value of this portion of the recovery stream towards recovery is reduced by the proposed action.

*5. Impacts on stocked Apache trout from wild fish populations present in the receiving waters.*

In 13 cases, the only fish in a stocking site are the Apache trout and whatever other species is proposed for stocking with it, for example, Ackre Lake contains only Apache trout and Arctic grayling. In other cases, there are wild fish populations, particularly wild rainbow, brook, or brown trouts living in the stocking site. These populations were established via historical stocking actions where some of the stocked nonnative fish survived and reproduced. In Fools Hollow Lake and Show Low Lake, Apache trout are stocked into warmwater fish populations where some species are self sustaining and others are maintained by stocking under the proposed action. Rainbow trout stocked into Show Low Creek may access Fools Hollow Lake downstream. Any Apache trout stocked into an area with established nonnative fish populations may be subject to competition or predation, and if wild rainbow trout are present, hybridization.

**Summary**

Apache trout stocked under the proposed action are at risk of competition, predation, and hybridization with other stocked species or wild nonnative fish populations. Since the Apache trout stocked under these circumstances do not contribute to recovery, and are excess to the population (are specifically bred and raised at the hatchery for use in recreational fishing), these adverse effects are of limited significance to the status of the recovery populations. The one instance where stocking is into a recovery population has a limited adverse effect to that recovery stream since only Apache trout are stocked.

*Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to Apache trout populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation, habitat loss, and competition for resources with other species.

### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

With the exception of portions of the West Fork Little Colorado River near the town of Greer, all stocking locations are on the ASNF, and land management activities that may affect the Apache trout are subject to section 7 consultation.

We are not aware of any new future non-Federal actions near the town of Greer that could have additional adverse effects to Apache trout. Completion of a recent land exchange with the ASNF to the west of the existing town may increase development of homes and commercial enterprises in the area. Recreational use of the river corridor near Greer is extensive and is likely to continue into the future at increasing rates.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline, and, for those past actions not part of the proposed action, part of cumulative effects. The Area Wide Analysis will discuss this effect in more detail.

### CONCLUSION

After reviewing the current status of Apache trout, the environmental baseline for the action area, the effects of the proposed sportfish stocking and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Apache trout. No critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on the Apache trout for the following reasons:

- The stocking of Apache trout for recreational fishing was included as a compatible action that contributes to the conservation of the species in the 1995 downlisting rule.
- Recreational fishing populations of Apache trout are, with one exception, separate from the recovery populations that are the primary conservation focus for the species. In that one instance, the effects of recreational fishing on the recovery population is not significant enough to degrade the conservation value of that population.
- There is a risk of contamination by nonnative fish species of recovery populations when such species are stocked below the barriers in recovery streams. Barrier failure is well documented, and currently exists at two streams near stocking sites. Contamination by nonnative fish following barrier failure has a short-term impact on the Apache trout in those streams, but does not permanently degrade the sites or prevent recovery.
- Apache trout from the recovery populations are not the source of fish for the recreational populations, thus there is no additional pressure on recovery streams to produce fish for recreational purposes. All recreational fish are bred in hatcheries that do, on occasion, provide fish for recovery streams; however, production capacity is adequate to meet both needs. If at any time production is inadequate to meet both needs, recovery Apache trout would take precedence over recreational Apache trout.
- The addition of new stocked warmwater and cold water sportfish species to sites where Apache trout are stocked for recreational purposes does not result in additional adverse effects to the species, as these Apache trout are not expected to establish populations in the stocking sites.
- Restoration efforts for Apache trout recovery populations affected by the Wallow Fire are anticipated to occur under ongoing recovery programs. The loss of Apache trout from streams designated for sportfishing is not a significant loss for the species as these sites do not contribute to recovery, and stocking under the proposed action will replace individuals lost to post-fire flooding.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which

include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by WSFR so that they become binding conditions of any grant or permit issued to AGFD, as appropriate, for the exemption in section 7(o)(2) to apply. WSFR has a continuing duty to regulate the activity covered by this incidental take statement. If WSFR (1) fails to assume and implement the terms and conditions or (2) fails to require the AGFD to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WSFR or AGFD must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

The action of stocking Apache trout for recreational purposes is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD has specific authority for management of endangered species, in part, manifested through State Section 6 Cooperative Agreements, which authorize management activities for threatened and endangered species. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD. Because stocking of Apache trout is for conservation purposes and consistent with the Act and the Cooperative agreement, take of Apache trout from the proposed stocking of Apache trout is legally permitted. Take from #1, 2, and 5 is included in this legally permitted take and is not considered in this incidental take statement. For #4, once stocked, Apache trout will be considered part of the recovery population; however, immediately following stockings there will be a short duration of increased density dependent intraspecific competition for resources, this take is also considered covered by the 4(d) rule since the entire creek is open for fishing. The potential take from # 3 relating to nonnative stocked fish accessing recovery streams is not covered by the special 4(d) rule and is considered in this incidental take statement.

The AESO anticipates incidental take of Apache trout will occur in three recovery streams (Mineral Creek, South Fork Little Colorado River, and West Fork Little Colorado River) as a result of this proposed action in the event of barrier failure that allows stocked rainbow trout to access the recovery streams. Apache trout are in the area where the take would occur, and

existing information indicates that the presence of rainbow trout in Apache trout habitat does result in take. The incidental take is expected to be in the form of harassment from competition for food and space, harm from mortality from predation, and, until conversion to triploid rainbow trout is completed, harm from hybridization.

As discussed in the effects of the action section, the condition of the barriers between the stocking reach and the recovery reach in each case varies, and cyclical maintenance is needed to ensure barrier integrity. The number of individual Apache trout incidentally taken if a barrier is compromised is difficult to quantify; so we propose a surrogate measure, that if the barrier is compromised and stocked rainbow trout are found above the barrier, incidental take will have occurred. Incidental take will be exceeded if this event occurs more than four times at any combination of barriers at the three streams.

#### EFFECT OF THE TAKE

In this biological opinion, the AESO determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

#### REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS (as appropriate)

The following reasonable and prudent measures are necessary and appropriate to minimize take of Apache trout:

1. AGFD shall reduce the risk of contamination of recovery streams by stocked rainbow trout.
2. AGFD shall monitor incidental take resulting from the proposed action and report to the FWS the findings of that monitoring.

#### TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, WSFR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Implementation of these terms and conditions is part of the CAMP.

The following term and condition implements reasonable and prudent measure #1 for Apache trout:

1. AGFD shall continue to work with partners to evaluate barrier conditions on the three streams, survey for nonnative fish in recovery streams, and repair barriers as part of the proposed action. These actions are described elsewhere and are not repeated here.

The following term and condition implements reasonable and prudent measure #2 for Apache

trout:

1. AGFD shall submit to WSFR a report of that monitoring with the annual report on implementation of the CAMP.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. WSFR, using information provided by AGFD, must immediately provide an explanation of the causes of the taking and review with the AESO the need for possible modification of the reasonable and prudent measures.

### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the USFWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that AGFD work with partners in the FWS and WMAT to ensure there are adequate supplies of hatchery-reared Apache trout for recreational stockings so that nonnative rainbow trout do not need to be used at stocking sites below recovery populations.
2. In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for Apache trout contingent upon funding availability as described in the CAMP document. The ability to implement recovery actions for Apache trout under the auspices of the CAMP provides conservation benefits to Apache trout that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

**Bonytail (*Gila elegans*)****DESCRIPTION OF THE PROPOSED ACTION**

Bonytail may be affected by stocking of sportfish in stocking sites along the lower Colorado River, and lower Gila River (Table 2). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 2: Stocking sites, sportfish species proposed for stocking, and potentially affected bonytail populations.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking</b> | <b>Bonytail population affected</b> |
|------------------------------|--------------------------------------|-------------------------------------|
| <i>Lower Colorado</i>        |                                      |                                     |
| La Paz County Park Pond      | ONMY, ICPU, LEMA                     | Colorado River                      |
| La Paz County Park Lagoon    | ONMY, ICPU, LEMA                     | Colorado River                      |
| Hidden Shores Golf Course*   | ONMY, ICPU, LEMA, MISA               | Colorado River                      |
| Yuma West Wetlands Pond*     | ONMY, ICPU, LEMA, MISA               | Colorado River                      |
| <i>Lower Gila</i>            |                                      |                                     |
| Fortuna Pond                 | ONMY, ICPU, LEMA, MISA               | Colorado River                      |
| Redondo Lake                 | ONMY, ICPU, LEMA, MISA               | Colorado River                      |
| Wellton Golf Course Pond*    | ONMY, ICPU, LEMA, MISA               | Colorado River                      |

**Conservation measures included in the proposed action**

Prior to any stocking into La Paz County Park Lagoon, signs similar to those used on Lake Havasu shall be posted at the lagoon describing bonytail to anglers and informing them of what to do should they catch a bonytail. These signs will remain in place as long as the barrier net is in place at the lagoon.

A barrier net shall be placed at the La Paz County Park Lagoon immediately prior to the stocking event and remain in place for seven days after the stocking event.

**STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)***Listing*

The bonytail was listed as an endangered species on April 24, 1980 with an effective date of May 23, 1980. The Bonytail Recovery Plan was updated in 1990 (USFWS 1990c) and Recovery Goals were approved in 2002 (USFWS 2002c). Critical habitat was designated in six river reaches in the historical range of the bonytail on March 21, 1994, with an effective date of April



20, 1994. In the Lower Colorado River Basin, critical habitat was designated in Lake Mohave, Lake Havasu, and a portion of the Colorado River above Lake Havasu.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the bonytail. This information was taken from the 2002 Recovery Goals (USFWS 2002c), and the Lower Colorado River Multi-Species Conservation Program Species Status documents (LCR MSCP 2005). Information in these documents is incorporated by reference.

### *Life history*

The bonytail was originally described from specimens taken in Arizona (Baird and Girard 1853). The bonytail is a highly streamlined fish with a very thin, pencil-like, caudal peduncle and large, falcate fins (Allan and Roden 1978). A nuchal hump may be present behind the head. Maximum length is about 600 millimeters (mm), with 300-350 mm more common (USFWS 1990A). Weights are generally less than one kilogram (kg) (Vanicek and Kramer 1969). Bonytail are long-lived fish; some have reached at least 49 years of age (Minckley 1985).

Bonytail are opportunistic feeders with a diet of terrestrial insects, plant material, and fish (USFWS 2002c). They are active mostly at night, and probably forage then.

Spawning takes place in the late spring to early summer (Jones and Sumner 1954, Wagner 1955) in water temperatures about 18°C (Vanicek and Kramer 1969). Riverine spawning of the bonytail has not been documented; however in reservoirs, gravel bars or shelves are used (Jones and Sumner 1954). Bonytail may be flexible in their spawning habitat needs as evidence from successful spawning in hatchery ponds at Dexter National Fish Hatchery and raceways at Willow Beach National Fish Hatchery.

### *Habitat use*

With their streamlined bodies, bonytail appear to be adapted to the Colorado River and large tributary streams. Even with these adaptations, this species does not select areas of high velocity currents and use of pools and eddies by the fish is significant (Vanicek 1967, Vanicek and Kramer 1969). Grinnell in 1914 captured bonytails in a backwater along the lower Colorado River. Bonytail use cover, particularly rocky crevices. There is limited information on migrations or other movements.

Habitat needs of larval and juvenile bonytails are not well known. Few larvae have been identified in the Lower Basin; in the Upper Basin, there is confusion between larvae of the bonytail and other chubs, so interpreting data is difficult. It is known that young prey on aquatic invertebrates, especially chironomid larvae and mayfly nymphs (Vanicek and Kramer 1969). It is likely that quiet water habitats are preferred habitats for young fish, given the success of raising them in man-made ponds. Backwaters temporarily or permanently connected to the main river channel are also believed to be important habitat for all life stages.

### Current distribution

The range-wide trend for the bonytail is for a continued range-wide decrease in wild populations due to lack of sufficient recruitment of young adults with the loss of old adults due to natural mortality. Loss of the extant wild populations is expected. Extinction of this fish in the wild throughout its historic range is being forestalled by the stocking of sub-adult fish into the Upper Colorado River Basin, and lakes Mohave and Havasu and the Parker Strip in the Lower Colorado River Basin. These stockings are intended to create populations of young adults that may be expected to persist for 40-50 years. To date, these stockings have had limited success.

### Threats

Changes to water flow due to construction of large water storage dams and operation of water diversions has affected bonytail habitats. Channelization as well as changes in flows has separated the floodplains from the existing river channels which has reduces habitat diversity. The introduction of nonnative fish species is the greatest impediment to survival and recovery of the bonytail. Predation on young bonytail is the primary adverse effect, although there may be some degree of competition for food or space.

### Conservation actions

The Upper Colorado River Endangered Fish Recovery Program (UCREFRP) has implemented considerable research, habitat management, nonnative species removal, and stocking actions to benefit the bonytail in Colorado, Utah, and Wyoming. The Lower Colorado River Multi-Species Conservation Plan (LCR MSCP) is also engaged in research and stocking actions to benefit the bonytail in the lower Colorado River of Arizona, California, and Nevada. Essential to these programs is the broodstock maintained at Dexter National Fish Hatchery and Technology Center (DNFH&TC) since the bonytail is functionally extinct in the wild.

### *Previous consultations*

Section 7 consultations on bonytail include programmatic efforts for the Upper Colorado River Basin and Lower Colorado River Multi-Species Conservation Program for new water diversions or changes in points of diversion. Information on these programs is available at their websites. Biological opinions on actions potentially affecting bonytail in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a

platform to assess the effects of the action now under consultation.

### **Description of the Action Area**

For the purposes of this consultation, there is one action area; the portion of the lower Colorado River from Parker Dam to and including the confluence with the lower Gila River located below Laguna Dam, and the lower Gila River upstream to Fortuna Pond.

#### **A. Status of the species and critical habitat within the action area**

Wild populations of bonytail do not exist in either action area. Construction of dams and subsequent changes to natural flow patterns and the introduction and establishment of nonnative fish species are the primary causes of the loss of this species from the wild.

Bonytail are currently stocked by the LCR MSCP into the lower Colorado River below Parker Dam. A total of 1,208 bonytail were stocked into the Parker Strip at River Island State Park in December 2007 (LCR MSCP 2009a), 535 in 2008 (LCR MSCP 2009b) and 2,506 in 2009 (LCR MSCP 2010). This site is about three miles upstream of La Paz County Park. Six bonytail were recaptured in 2007 during electrofishing surveys (Schooley et al. 2008). Stockings of bonytail and subsequent monitoring are expected to continue in this reach for the foreseeable future in an attempt to establish a population. Survival rate for the stocked bonytails is unknown; and few were contacted post-stocking. The existing nonnative fish population in the Parker Strip is robust with significant numbers of potential predators and competitors.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

As noted previously, creation of dams and subsequent water management actions and the introduction of nonnative fish species are the primary factors affecting bonytail in the action area. All bonytail present are the result of past or ongoing stocking actions.

The LCR MSCP is a combined section 7 and section 10 that covers management of the lower Colorado River by the Bureau of Reclamation (Reclamation), and water uses by Federal and non-Federal parties. Part of the mitigation required for the covered actions involves conservation for bonytail, particularly stocking into the Parker Strip and areas downstream above Imperial Dam, creation of isolated backwaters, monitoring of stocked fish, and targeted research to address issues that may interfere with successful establishment of bonytail populations. These mitigation and conservation actions do not alter the physical conditions in the river that result from water management, nor do they address nonnative species effects except that the isolated backwaters will be managed to keep nonnative fish out.

### **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent

actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the bonytail are in the recovery goals document (USFWS 2002c). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on bonytail.

No effects to bonytail are identified for La Paz County Park Pond, Hidden Shores, or Yuma West Wetlands since these are closed systems that do not have connectivity to the river. These sites are not discussed further in this section.

#### *La Paz County Park Lagoon*

Bonytail are stocked into the Parker Strip of the lower Colorado River by the LCR MSCP. Stocked bonytail are considered listed since this is not a 10j population. The proposed action is the stocking of up to 6,000 rainbow trout or catfish or bluegill (or a combination) during the spring for fishing derbies/clinics.

There is limited exposure of bonytail by stocked fish in the lagoon because a block net is set in place prior to stocking to prevent stocked fish from reaching the river and fish from the river from entering the backwater. Further, the stocked fish are likely in the site for about two weeks (based on stocking all 6,000 fish in two lots within a few days of each other) and being fished out quickly by the fishing clinics and post-clinic angling. An unknown number of stocked fish may still be present in the lagoon after the block net is removed. The number of stocked fish released after the blocking net is removed is likely to be very low, and compared to the numbers of their conspecifics resident in the river is unlikely to have any meaningful effect on those local populations.

These fish may then move into the main channel of the Colorado River and use other habitats that may be occupied by the bonytail. Rainbow trout would not be expected to persist beyond a few months due to high water temperatures in the river. Bluegill and channel catfish may persist and be incorporated into the existing populations of these species in the river.

The LCR MSCP stocks 4,000 bonytail into the river generally in fall and spring. The stocked bonytail are within the size range of the catchable (8-12 inches (200-300 mm) fish stocked into the backwater. Immediate predation by the stocked fish on bonytail is likely to be limited due to similar sizes at stocking; however, any stocked warmwater fish that survive and remain in the backwater may be able to prey on subsequently stocked bonytail that access the backwater. Stocked channel catfish that leave the backwater once the block net is removed and grow to larger sizes in the river may have exposure to recently stocked bonytail in the following years; however, the number of such fish is likely to be very limited and unlikely to have any meaningful effect.

Bonytail use pools and eddies in rivers and also do well in backwater habitats (LCR MSCP 2005) so their presence in the lagoon (which is a backwater open to the river) would not be unexpected. Bonytail take cover in rock piles or other cavity-based cover during the day (Marsh 2004). Channel catfish also use these types of cavities for cover during the day (Moyle 2002). The shoreline of the lagoon has only a limited amount of rip-rap area that provides cavities usable by bonytail or channel catfish. Bluegill or rainbow trout are not likely to use this type of habitat for cover (bluegill are associated with aquatic plants [Moyle 2002], while rainbow trout may use a variety of cover including rocks, logs, vegetation and undercut banks [Raleigh et al. 1984] but not cavities). Since catfish are not proposed for stocking except when rainbow trout not available, the number of times over the 10-year period of the consultation that channel catfish and bonytail could compete for the same shelter is low. During the nighttime activity period for the bonytail, they will be in habitats occupied by bluegill or rainbow trout.

Bonytail feed in the open water column and from the bottom (LCR MSCP 2005). Channel catfish are primarily bottom feeders (McMahon and Terrell 1982), but do use the water column to some extent. Bluegill feed in all available habitats (Moyle 2002). Rainbow trout feed primarily in the open water but do feed on the bottom in some cases (Moyle 2002). Given the time of year of the stocking (January-March) and the likely water temperatures present (10-13°C) (Minckley 1979), feeding rates by bonytail, channel catfish (growth stops below 18°C [McMahon and Terrell 1982]) and bluegill (little feeding around 10°C [Carlander 1977]) are likely to be low, reducing the opportunity for competition for food, though some feeding by all species is expected. Rainbow trout do feed at these temperatures (Carlander 1969) and may forage at any time of the day or night (with peaks at dawn and dusk [Moyle 2002]), and bonytail are feeding at night (Mueller 2006), the overlap is limited.

Bonytail spawn in April in the lower Colorado River (Mueller et al. 2003). Currently, no reproduction of stocked bonytail has been recently documented in the lower Colorado River. While the stocked fish (of any species) might still be present in the river (after leaving the lagoon once the net was removed) during the spawning season of the bonytail (if and when such spawning is documented), the low numbers of stocked fish released into the river make it unlikely that they would contact bonytail eggs or larvae should they be present.

The effects to bonytail from the stocking of up to 6,000 cold and/or warmwater fish per year into La Paz County Park Lagoon should also be considered in light of the type of stockings and the existence of the large nonnative fish community that already exists in the river and in the backwater. The extensive population of nonnative fish species that includes self-sustaining populations of all the species proposed to be stocked (except rainbow trout) is clearly a significant factor in the potential for successful recruitment of bonytail in this section of the lower Colorado River.

Angling occurs at the Lagoon at other times than just during and after the stocking actions. Any bonytail in the vicinity that uses the Lagoon is at risk of being taken by anglers if it is in the Lagoon. This risk may be higher during those periods when many anglers are using the Lagoon because of the stocking action.

*Lower Gila Complex*

Three stocking sites are present in this complex; Wellton Golf Course Pond, Fortuna Pond, and Redondo Lake. Wellton Golf Course Pond and Redondo Lake are closed systems with no connection to the lower Gila River and fish stocked there cannot leave the stocking site. Fortuna Pond has a limited amount of connectivity to the lower Gila River and fish may move from the Pond to the river and access the mainstem Colorado River. The confluence of the Gila and Colorado is located below Laguna Dam. There are no recent records for bonytail in the Colorado River below Imperial Dam (Imperial Dam is upstream of Laguna Dam). Bonytail are stocked into the closed Imperial Ponds upstream of Imperial Dam, and into the mainstem Colorado River in the Parker Strip (described in the section on La Paz County Park). It is highly unlikely that any bonytail stocked into the Colorado River would access the river below Laguna Dam and encounter either a stocked fish or its progeny derived from Fortuna Pond. With the exception of rainbow trout, all species being stocked into Fortuna Pond maintain robust, self-sustaining populations in the Colorado River below Imperial Dam and the additive effect of any fish from Fortuna Pond to the extant populations of nonnative fish is not likely to be meaningful.

*Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to bonytail populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002c). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect bonytail. Susceptibility and concomitant impacts of disease and

parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The land area surrounding seven stocking sites on the lower Colorado-lower Gila rivers action area is a mix of private, state, Bureau of Land Management, Fish and Wildlife Service, Bureau of Reclamation, and Tribal lands. The sites themselves are on private lands (two), state land (two), or recreational purposes leased Federal lands (three). Ongoing land uses around the non-Federal properties are not expected to change during the 10-year period covered by the proposed action, with agricultural uses, urban/suburban development, and recreational uses continuing. Water management of the lower Colorado River is under Federal control, and effects of that management are covered by the LCR MSCP. Fisheries on the lower Colorado River are managed by either AGFD or California Department of Fish and Game.

Live bait fish species are legal for use in all sites, with some species available from dealers and others required to be collected on site. Waterdogs are allowed, as is use of crayfish; however, live crayfish may only be used or transported on the Colorado River in a limited area along the river.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline, and, for those past actions not part of the proposed action, part of cumulative effects. The Area-Wide Analysis will discuss this effect in more detail.

## CONCLUSION

After reviewing the current status of bonytail, the environmental baselines for the action areas, the effects of the proposed stocking of sportfish and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the bonytail. Critical habitat for this species has been designated at Lake Havasu and Lake Mohave upstream of the stocking locations; however, this action does not affect that area and no destruction or adverse modification of that critical habitat is anticipated.

We present this conclusion on bonytail for the following reasons:

- Stocking into the La Paz County Park Lagoon provides limited opportunity for adverse effects to bonytail through competition for food and space with stocked fish. The length of exposure is low; the number of bonytail potentially exposed to the stocked fish is low due to the block net and narrow (two week) stocking period; and the amount of

competition is low. The overall significance to the bonytail in the Parker Strip area of the Colorado River is low.

- No effects to bonytail are anticipated from stockings at Hidden Shores, La Paz County Park Pond or Yuma West Wetlands since these sites are not connected to the river and fish stocked there will not reach the river. Thus there are no additional effects due to these sites
- It is highly unlikely that any bonytail stocked into the Colorado River would access the river at the confluence of the Gila River and encounter either a stocked fish or its progeny derived from Fortuna Pond. With the exception of rainbow trout, all species being stocked into Fortuna Pond maintain robust, self-sustaining populations in the Colorado River below Laguna Dam and the additive effect of any fish from Fortuna Pond to the extant populations of nonnative fish is insignificant. No effects to bonytail are anticipated from stockings at Redondo Lake and Wellton Golf Course pond since these sites are not connected to the Gila River. Thus there are no additional effects due to these sites.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### **AMOUNT OR EXTENT OF TAKE**

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.



We are unable to meet the two conditions for incidental take for the following sites and reasons:

- La Paz County Park Lagoon: The Lagoon is one of only a few backwaters in this reach of the Colorado River, and it is likely that stocked bonytail will be using the Lagoon during the year. The first condition is met. Stocked bonytail and the stocked sportfish are of similar size, and predation is not likely to occur on bonytail. Further, the stocked sportfish will only be in the Lagoon for a limited time, and the opportunity for competition for food and space will be limited and unlikely to rise to the level that take would occur. Thus, the second condition is not met.

Currently, few bonytail survive post-stocking and reproduction of stocked bonytail is extremely rare. However, if reproduction is documented in the future, that might constitute new information that could change our determination about the potential for incidental take due to reasonable certainty that small bonytail were present.

#### EFFECT OF THE TAKE

In this biological opinion, the AESO determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

#### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

#### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We have not identified any conservation recommendations for the bonytail for this consultation. The conservation measures are sufficient to address the effects of the proposed action.

#### **Chiricahua leopard frog (*Lithobates [=Rana] chiricahuensis*) and proposed critical habitat**

## DESCRIPTION OF THE PROPOSED ACTION

Chiricahua leopard frogs may be affected by stocking in the Black River, Lower Verde, San Francisco, Santa Cruz, and Tonto Creek complexes. Stocking sites and species to be stocked are listed in Table 3. New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 3: Stocking sites, sportfish species proposed for stocking, and potentially affected Chiricahua leopard frog populations.

| <b>Stocking complex/sites</b> | <b>Species proposed for stocking</b> | <b>Proposed critical habitat unit</b>          | <b>Population affected (R= reintroduced)</b> |
|-------------------------------|--------------------------------------|------------------------------------------------|----------------------------------------------|
| <i>Black River</i>            |                                      |                                                |                                              |
| Ackre Lake                    | ONAP, THAR                           | Unit 6: Mogollon Rim-Upper Gila                | East Fork Black River drainage (R)           |
| Big Lake                      | ONMY, SAFO, ONCL, ONAP               | Unit 6: Mogollon Rim-Upper Gila                | East Fork Black River drainage (R)           |
| Crescent Lake                 | ONMY, SAFO                           | Unit 6: Mogollon Rim-Upper Gila                | East Fork Black River drainage (R)           |
| East Fork Black River         | ONAP, ONMY*                          | Unit 6: Mogollon Rim-Upper Gila                | East Fork Black River drainage (R)           |
| West Fork Black River         | ONAP                                 | Unit 6: Mogollon Rim-Upper Gila                | East Fork Black River drainage (R)           |
| <i>Lower Verde River</i>      |                                      |                                                |                                              |
| East Fork Verde River         | ONMY                                 | Unit 5: Mogollon Rim-Verde River               | Ellison/Lewis Creek (R)                      |
| <i>San Francisco River</i>    |                                      |                                                |                                              |
| Luna Lake                     | ONMY, ONCL                           | Unit 6: Mogollon Rim-Upper Gila                | Near Reserve                                 |
| <i>Santa Cruz River</i>       |                                      |                                                |                                              |
| Parker Canyon Lake            | ONMY, ICPU, LEMA*, LEMI*             | Unit 2: Santa Rita-Huachuca-Ajos-Bavispe       | Scotia Canyon (R)                            |
| Peña Blanca Lake              | ONMY                                 | Unit 1: Tumacacori-Atascosa-Pajarito Mountains | Peña Blanca                                  |
| <i>Tonto Creek</i>            |                                      |                                                |                                              |
| Christopher Creek             | ONMY                                 | Unit 5: Mogollon Rim-Verde River               | Reintroduction site                          |
| Haigler Creek                 | ONMY                                 | Unit 5: Mogollon Rim-Verde River               | Reintroduction site                          |
| Tonto Creek                   | ONMY                                 | Unit 5: Mogollon Rim-Verde River               | Reintroduction site                          |

Conservation measures included in the proposed action

Chiricahua leopard frog is a priority species for conservation in the proposed action and as such,

will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

For warmwater sportfish stocking actions via contract vendors at sites where effects to Chiricahua leopard frogs are a concern, the “sensitive areas” HACCP plan shall be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan shall involve the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sportfish. Loads containing unwanted aquatic organisms will be refused and not stocked. This measure will be implemented as needed.

For coldwater sportfish stocking actions at sites where effects to Chiricahua leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery shall be in place to reduce the risk of contamination of the fish to be stocked. This measure has been ongoing and will continue to be implemented. Funds expected to implement these activities do not contribute to meeting the average annual funding requirement of \$500,000.

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild or reintroduced populations of Chiricahua leopard frog.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

AGFD commits to provide for three populations of Chiricahua leopard frog either through securing existing but threatened populations or establishment of new conservation populations. The first such population will be initiated within four years, the second within six years, and the

third within eight years.

AGFD will share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and gartersnake populations in the San Francisco River drainage (non-mandatory measure).

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

The Chiricahua leopard frog (*Lithobates chiricahuensis*) was listed as a threatened species without critical habitat in a Federal Register notice dated June 13, 2002. Included was a special rule to exempt operation and maintenance of livestock tanks on non-Federal lands from the section 9 take prohibitions of the Act. The Recovery Plan was signed in 2007 (USFWS 2007b). The Ramsey Canyon leopard frog (*Lithobates “subaquavocalis”*), found on the eastern slopes of the Huachuca Mountains, Cochise County, Arizona, has recently been subsumed into *Lithobates chiricahuensis* (Crother 2008) and recognized by the FWS as part of the listed entity (USFWS 2009c). Critical habitat for the Chiricahua leopard frog was proposed on March 15, 2011 (USFWS 2011a).

##### Critical habitat

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species’ eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (USFWS and NMFS 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those

units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

For the Chiricahua leopard frog, the proposed critical habitat was based on recovery and management units contained in the recovery plan. For this analysis, we shall assume that any significant effects to the PBFs of critical habitat could result in a loss of conservation value for that critical habitat unit.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Chiricahua leopard frog. This information was taken from the 2007 Recovery Plan (USFWS 2007b). Information in this document is incorporated by reference.

#### Life history

The life history of the frog is complex, with eggs and larvae (tadpoles) that are entirely aquatic and adults that are primarily aquatic. Post-metamorphic juveniles and adults are generally inactive between November and February; however, tadpoles can remain active under the ice in 41°F water. Tadpoles metamorphose to froglets in three to nine months, although some may overwinter before metamorphizing. Juvenile frogs are small; approximately two inches and adults are up to 5.4 inches.

Egg masses have been reported in all months except November through January, with oviposition in June uncommon. Water temperature may be a governing factor in oviposition; sites with warmer water, such as spring-fed sites, may have oviposition year round. Frog populations at elevations below 5,900 feet tend to oviposit from spring to late summer, with most activity before June. Frog populations at elevations over 5,900 feet oviposit in June through August. Egg masses are attached to submerged vegetation. Hatching is in approximately 14 days (depending on temperature) and the tadpoles remain in the water to feed.

Tadpoles are primarily vegetarian, with bacteria, phytoplankton, green algae, submerged vascular plants, and detritus forming the forage base. Adult frogs are carnivores, with aquatic and terrestrial invertebrates and small vertebrates (fish, smaller frogs) forming the forage base.

#### Habitat use

Historically, the frog was an inhabitant of a wide variety of aquatic habitats, including cienegas, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet. Frogs may be active during the day or at night, with water and air temperature and wind predictors of activity. Permanent waters are better frog habitat, since the eggs and tadpoles must remain in water. Underwater cover, including plants, deep pools, undercut banks, and root masses are important for retreats from predators and as shelter during cold periods. Juvenile and adult frogs may disperse from the breeding site using uplands (during the rainy season) and stream courses. Movement of up to five miles (down-or up-stream from the point of origin) is

documented. Tadpoles may be carried downstream by normal or higher flows. Where several breeding sites are located in dispersal range, a metapopulation can form.

#### Current distribution

The range of the Chiricahua leopard frog includes central and southeastern Arizona; west-central and southwestern New Mexico; and, in Mexico, northeastern Sonora, the Sierra Madre Occidental of northwestern and west-central Chihuahua, and possibly as far south as northern Durango (Platz and Mecham 1984, Degenhardt et al. 1996, Lemos-Espinal and Smith 2007, Rorabaugh 2008).

Based on 2009 data, the species is still extant in the major drainage basins in Arizona and New Mexico where it occurred historically; with the exception of the Little Colorado River drainage in Arizona and possibly the Yaqui drainage in New Mexico. It has not been found recently in many rivers within those major drainage basins, valleys, and mountains ranges, including the following in Arizona: White River, West Clear Creek, Tonto Creek, Verde River mainstem, San Francisco River, San Carlos River, upper San Pedro River mainstem, Santa Cruz River mainstem, Aravaipa Creek, Babocomari River mainstem, and Sonoita Creek mainstem. In southeastern Arizona, no recent records (1995 to the present) exist for the Pinaleno Mountains or Sulphur Springs Valley; and the species is now apparently extirpated from the Chiricahua Mountains. Moreover, the species is now absent from all but one of the southeastern Arizona valley bottom cienega complexes. In many of these regions Chiricahua leopard frogs were not found for a decade or more despite repeated surveys. As of 2009, there were 84 sites in Arizona at which Chiricahua leopard frogs occur or are likely to occur in the wild, with additional four captive or partially captive refugia sites. At least 33 of the wild sites support breeding. In 2009 in New Mexico, Chiricahua leopard frogs were found at 39 sites, at least 26 of which were breeding sites. The species has been extirpated from about 80 percent of its historical localities in Arizona and New Mexico. Nineteen and eight localities are known from Sonora and Chihuahua, respectively. The species' current status in Mexico is poorly understood; however, it has been found in recent years in western Chihuahua.

#### Threats

The primary threats to this species are predation by nonnative organisms and die offs caused by a fungal skin disease – chytridiomycosis (see Appendix D for a complete discussion of this disease). Additional threats include drought; floods; degradation and loss of habitat as a result of water diversions and groundwater pumping; poor livestock management; altered fire regimes due to fire suppression and livestock grazing; mining, development, and other human activities; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; and environmental contamination (USFWS 2007b). Some threats, such as introduced nonnative predators and the threat of catastrophic wildfire, appear to be less important south of the border, particularly in the mountains where Chiricahua leopard frogs have been found (Gingrich 2003, Rosen and Melendez 2006, Rorabaugh 2008).

Chytridiomycosis is a significant concern throughout the range of the frog and has eliminated the

species from several areas whereas in other sites, it has caused less mortality. Warmer sites with southern exposures, lower elevations, and warm springs to provide water are less affected by the disease. As of 2007, this disease was known from eight populations in Arizona. The disease organism, a fungus, is highly virulent and any surviving individuals may be carriers as can bullfrogs, and tiger salamanders. Research has also implicated fish, aquatic insects, and birds as carriers of this disease organism likely through physical transport of the organism on their bodies rather than actual infections. However, the results are suggestive rather than conclusive and demonstrate the need for additional rigorous testing. The spores can survive drying for one to three hours. It is unknown how long non-ranid frog hosts may harbor the fungus without local ranid frog populations to act as disease reservoirs. Bullfrogs are an important vector for the spores as they disperse widely and are themselves resistant to the disease. Inoculation doses that can result in disease manifestation are low, which further increases the opportunity for transmission to new areas. Any human activity that moves infected organisms to new locations is a vector for concern.

The species is now limited primarily to headwater streams, springs and cienegas, and cattle tanks into which nonnative predators (e.g. sportfishes, American bullfrogs, crayfish, and tiger salamanders) have not yet invaded or where their numbers are low (USFWS 2007b). Many of these sites are not dependably perennial, which influences the ability of any one site or small number of sites to maintain a population. The large valley-bottom cienegas, rivers, and lakes where the species occurred historically are populated with nonnative predators at densities with which the species cannot coexist. Habitats with significant amounts of underwater complexity from vegetation, rocks or other forms of cover may support frogs when nonnative predators are present; however, this has not been fully examined. Many nonnative fish species prey on frogs, including species proposed for stocking under the proposed action: bluegills and largemouth bass, with channel catfish and rainbow trout also likely predators. Generally, where nonnative bullfrogs or predatory fish are present, the frogs are absent.

No studies have been conducted on the effects of introduced trout on the Chiricahua leopard frog. However, there is no reason to believe rainbow trout would not feed upon Chiricahua leopard frog tadpoles. Rainbow trout do prey on other ranid frog tadpoles (Bradford 1989, Bradford et al. 1993) and can have effects on frog populations. Chiricahua leopard frog occurred historically at a number of the large lakes in the Mogollon Rim region of east-central Arizona, but no longer occurs at these sites (e.g. Hawley Lake – 1967, Blue Lake – 1984, Horseshoe Lake – 1967, Blue Ridge Reservoir – 1972, Nelson Reservoir – 1971, Rainbow Lake – 1972, Tonto Lake – 1971, Baker lake – 1980, and Luna Lake ~1979; year shown is the last year Chiricahua leopard frogs were found). These lakes all contained introduced trout and in some cases, other fishes and the last record of a Chiricahua leopard frog at any of these sites is 1984. Crayfish began to expand in the White Mountains/Mogollon Rim area after they were introduced into Arizona in the 1960s and were established in many locations by the mid 1990s. Both stocked trout and the spread of crayfish may be factors in the decline.

### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the Chiricahua leopard frog recovery plan. Conservation actions

for the Chiricahua leopard frog are ongoing and include head-starting and captive breeding at zoos, museums, and other safe refuges with subsequent stocking into the wild in the Black River and Verde River drainages. Other reintroductions or efforts to establish populations also occur in other portions of the range. The Gila River Basin Native Fishes Conservation Program (also known as the Central Arizona [CAP] Program) also includes a component for CLF for head-starting eggs and tadpoles to provide individuals for reestablishment. Two umbrella Safe Harbor Agreements under which non-Federal landowners can enroll their properties with a certificate of inclusion are in place in Arizona and southwestern New Mexico. A third Safe Harbor Agreement is in place for a ranch in southeastern Arizona. These agreements provide opportunities for conservation on private lands.

As part of the 2011 proposed action to stock warmwater sportfish at Peña Blanca Lake (formal consultation 22410-2010-F-0330, the AGFD, Coronado National Forest (CNF) and AESO agreed to implement a suite of conservation measures as part of that proposed action in the Peña Blanca watershed to enhance recovery opportunities for Chiricahua leopard frogs in the watershed. Those conservation measures are listed below:

1. Permanent informational signs in English/Spanish will be posted in prominent locations near each parking area at Peña Blanca Lake that will include, at a minimum, a list of the sportfish species currently in the Lake and the fishing regulations for Peña Blanca Lake; including that use of live bait, with the exception of waterdogs, is illegal, and release of any live animals is illegal. The size and content of the signs will be mutually developed and agreed to by AGFD, CNF, and AESO. Temporary signs will be in place prior to release of the first stocking of warmwater fish. Permanent signs will be in place within six months of the date of this opinion. These signs will include educational information on conservation and identification of Chiricahua leopard frog and lowland leopard frog (*Lithobates yavapaiensis*), the identification of bullfrogs, and the threat of exotic species including bullfrogs. These signs will be worded in a way that encourages the public to participate in frog conservation and good stewardship of the Lake. If possible, the partners will develop an interactive sign that includes vocalizations of Chiricahua leopard frog, lowland leopard frog, and bullfrogs. The partners will also provide an AGFD phone number and email address to report bullfrogs or violations of fishing regulations.
2. The AGFD will, within 15 days of the erection of the sign described in Conservation Measure 1, submit to AESO a brief, written report of the installation and text of the sign.
3. The AGFD will, within 15 days of fish stockings, provide AESO with a copy of the invoice or other documentation of the date, number, age class, and species of fish stocked.
4. To maintain habitat for the Chiricahua leopard frog, the AGFD and CNF will protect naturally developing shoreline, aquatic, and emergent vegetation at Peña Blanca Lake. The AGFD and CNF may remove invasive plant species to prevent



further spread. The AGFD and CNF will not remove downed trees or other vegetation debris in the water or on the banks and will not harvest or cut aquatic or emergent vegetation except where necessary to maintain access or protect public safety. This does not extend to prohibiting the public from removing vegetation in the course or pursuit of angling, boating, swimming, or other recreational activities.

5. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) regulation assessment and risk analysis to develop recommendations to amend live bait regulations. These recommendations will be presented to the AGFD Commission for implementation consideration.
6. AGFD will reject fish shipments that contain any deleterious non-target species (tadpoles, crayfish, snails, plants, etc.). AGFD personnel checking fish shipments will receive the appropriate training to detect non-target species and will be authorized to reject shipments.
7. The AGFD, CNF, and AESO will coordinate the development of, and implementation of, a survey/monitoring plan for ranid frogs within three months of the date of this biological opinion. This survey/monitoring plan will be adaptable in requirements for intensity, type, and focus of the survey/monitoring effort. Implementation of the survey/monitoring plan will be dependent on agency resource availability. The plan will include the provision that if bullfrogs are detected during the survey, a reasonable effort will be made to remove them, and their presence will be reported to AESO as soon as practicable after the survey. If this monitoring reveals a large bullfrog population is present and a more intensive bullfrog removal program is needed, it will be reported to AESO immediately and AGFD, CNF, and AESO will coordinate development of a more intensive bullfrog removal plan, with implementation dependent upon resource availability of the three agencies. Each agency conducting surveys will send the other two agencies completed survey forms and summary reports for the work it accomplished. CNF will prepare summary reports on its actions, and will provide them to AESO as part of the annual CNF section 7 reporting.

The survey/monitoring plan will provide methods for implementation at the following three areas:

- a. Selected stock ponds, tanks, and pools within a five-mile radius of Peña Blanca Lake. The minimum focus is on the presence of Chiricahua leopard frog, lowland leopard frog, and bullfrogs and the removal of bullfrogs at these sites.
- b. Surveys for bullfrogs at Peña Blanca Lake in conjunction with, but not limited to, annual fish surveys by AGFD. The minimum focus is the presence and removal of bullfrogs at the lake
- c. Annual monitoring of Chiricahua leopard frog and lowland leopard frog at

## Peña Blanca Lake.

8. The CNF will provide training and information to employees to assure that CNF employees working at Peña Blanca Lake are aware of the potential for unauthorized fish stocking and are prepared to inform the public and to report violations.
9. Fish transport water will not be disposed of in any location where it can reach a wet site.
10. AGFD will implement their HACCP process to minimize the likelihood of transporting non-target organisms from the hatcheries to Peña Blanca Lake (Gurtin, undated). AGFD requires that all fish imported into the State be accompanied with fish health certificates certifying them to be disease and parasite free. The five steps in the HACCP planning process are:
  - Describe the activity
  - Identify the potential hazards
  - Diagram the flow of steps for the activity
  - Fill out a hazard analysis worksheet
  - Complete the HACCP plan form

## Critical habitat

The 2011 proposed rule (USFWS 2011a) contained 40 critical habitat units across the range of the species in Arizona and New Mexico. When critical habitat was proposed, the FWS determined the physical and biological features (PBFs) for Chiricahua leopard frog. PBFs include those habitat features required for the physiological, behavioral, and ecological needs of the species. The proposed rule used the Recovery Units described in the Recovery Plan to identify the critical habitat units that support the conservation of the species within those Recovery Units. Proposed critical habitat units included those where the Chiricahua leopard frog was known to exist at the time of listing, and sites where reintroductions have been made to restore populations within those Recovery Units. All units were deemed essential for the conservation of the species.

Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, we have determined that the PBFs essential to the conservation of the Chiricahua leopard frog are:

- (1) Aquatic Breeding Habitat and Immediately Adjacent Uplands. These aquatic sites and uplands exhibit the following characteristics:
  - (a) Perennial or nearly perennial pools or ponds at least 6.0 ft (1.8 m) in diameter and 20 in. (0.5 m) in depth;
  - (b) Wetted in most years, and do not or only very rarely dry for more than a month;
  - (c) pH greater than or equal to 5.6;

- (d) Salinity less than 5 parts per thousand;
- (e) Pollutants absent or only present at levels that do not exceed the tolerances of the Chiricahua leopard frog;
- (f) Emergent and or submerged vegetation, root masses, undercut banks, fractured rock substrates, or some combination thereof; but emergent vegetation does not completely cover the surface of water bodies;
- (g) Nonnative crayfish, predatory fishes, bullfrogs, Barred tiger salamanders, and other introduced predators absent or occurring at levels that do not preclude presence of the Chiricahua leopard frog;
- (h) Absence of chytridiomycosis or conditions (e.g., water temperatures that do not drop below 20° C (68° F), pH of greater than 8 during at least part of the year) that allow persistence of Chiricahua leopard frogs with the disease; and
- (i) Uplands immediately adjacent to breeding sites that Chiricahua leopard frogs use for foraging and basking.

(2) Dispersal Habitat. Consisting of ephemeral, intermittent, and or perennial drainages that are generally not suitable for breeding, and associated uplands that provide overland movement corridors for frogs among breeding sites in a metapopulation with the following characteristics:

- (a) Are not more than 5.0 mi (8.0 km) along perennial drainages, 3.0 mi (4.8 km) along ephemeral or intermittent drainages, 1.0 mi (1.6 km) overland, or some combination thereof not to exceed 5.0 mi (8.0 km);
- (b) Provide some vegetation cover for protection from predators, and in drainages, some ephemeral, intermittent, and or perennial aquatic sites, and
- (c) Are free of barriers that block movement by Chiricahua leopard frogs, including urban, industrial, or agricultural development; or reservoirs that are 50 ac (20 ha) or more in size and stocked with predatory fishes, bullfrogs, or crayfish; highways that do not include frog fencing and culverts; and walls, major dams, or other structures that physically block movement.

With this proposed designation of critical habitat, we intend to conserve the PBFs essential to the conservation of the species through the identification of the appropriate quantity and spatial arrangement of the PBFs sufficient to support the life-history functions of the species. Because not all life-history functions require both PBFs, not all areas proposed as critical habitat will contain both PBFs. Each of the areas proposed in this rule have been determined to contain sufficient PBFs, or with reasonable effort, PBFs can be restored to provide for one or more of the life-history functions of the Chiricahua leopard frog.

All areas proposed for designation as critical habitat will require some level of management to address the current and future threats to the Chiricahua leopard frog and to maintain or restore the PBFs. Special management in aquatic breeding sites will be needed to ensure that these sites provide water quantity, quality, and permanence or near permanence; cover; and absence of extraordinary predation and disease that can affect population persistence. In dispersal habitat, special management will be needed to ensure frogs can move through those sites with reasonable success.

Recent wildfires have affected the PBFs of proposed critical habitat in Recovery Unit 1 in southern Arizona (Murphy Fire- unit 5: Sycamore Canyon and unit 6: Peña Blanca Lake and spring and associated tanks), Recovery Unit 2 in southern Arizona (Greaterville Fire- unit 8: Eastern Slope of the Santa Rita Mountains; Monument Fire- unit 12: Beatty's Guest Ranch, unit 13: Carr Barn Pond, and unit 14: Ramsay and Brown Canyons, and in Recovery Unit 6 in the Black River drainage (Wallow Fire-unit 26: Concho Bill and Deer Creek and unit 27: Campbell Blue and Coleman Creeks) Areas containing proposed critical habitat units may have experienced a range of burn severities and fire could have removed all or a portion of the surrounding vegetation component (including trees, shrubs, grasses, and forbs). Post-fire storm water runoff may have carried ash or sediment into the streams, resulting in poor water quality and sedimentation events that reduced or eliminated particular habitat features. The extent of damage to the PBFs of proposed critical habitat units considered in this BCO is not well known at this time. Where specific information is available, it will be discussed in the stocking site analysis.

#### *Previous consultations*

Section 7 consultations on Chiricahua leopard frog include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, watershed management, water quality, and other issues), for conservation activities covered under the Safe Harbor Agreements, and more site-specific efforts that are more focused on implementing recovery actions. Biological opinions on actions potentially affecting Chiricahua leopard frog in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

Chiricahua leopard frogs are affected by sportfish stocking actions in six disjunct watersheds. Each watershed will be described and analyzed separately.

#### *Black River Complex*

#### **Description of the Action Area**

As described in Table 3, there are five stocking sites under consideration, all stocked with one or more coldwater fish species. The action area is defined as the connected watersheds forming the

Black River from its headwaters to its confluence with Fish Creek. This area encompasses all stocking sites and connecting waters. While the entire complex is included because of connectivity, the potential effects to Chiricahua leopard frogs in this complex are largely from stocking at Big Lake and the East Fork Black River sites.

#### **A. Status of the species and proposed critical habitat within the action area**

There are historical records for Chiricahua leopard frogs from six sites within the complex; Crabtree Creek (1988), Deer Creek (2001), East Fork Black River (Buffalo Crossing footbridge) (1974), East Fork Black River (Three Forks) (2008), Concho Bill Spring (2009), and Lake Sierra Blanca (2008) (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M.J. Sredl pers. comm.). A leopard frog was reported from the confluence of Double Deep Creek and Fish Creek in 2003 that may have been a Chiricahua leopard frog (T. Hare, pers. comm. 2003). There have been 182 surveys at 91 sites within the Black River buffered stocking complex from 1969 to 2009 with most surveys taking place between 1990 and 2009 (HDMS, Arizona Game and Fish Riparian Herpetofauna Database, M.J. Sredl pers. comm.). As of 2008, the only natural population of Chiricahua leopard frogs remaining in the drainage at Three Forks had disappeared, likely due to the spread of crayfish in the system beginning in 1993. The status of the two reintroduction populations at Concho Bill Spring (most recently stocked in 2008) and Lake Sierra Blanca (most recently stocked in 2004) is uncertain. No frogs were observed at either site in 2010; although frogs are difficult to detect, particularly at Lake Sierra Blanca. Four new reintroductions were made in 2010 into the Black River drainage: at Firebox Lake and Ridge Top Tank in adjoining drainages that flow north to the East Fork Black River near Aspen Campground, Dry Lake Tank in a tributary to Open Draw that joins the East Fork Black River above the stocking reach, and Head Tank, in the Deer Creek drainage which joins the East Fork Black River near the Deer Creek Campground.

The 2011 Wallow Fire burned over a considerable amount of the headwaters of the Black River. The mosaic of burn severity on the landscape is complex, and the full effects to reintroduction populations in the drainage are unknown. At some sites, for example near Three Forks, the riparian areas beside the stream did not burn; however, the forested slopes did burn so there may be runoff events that bring ash and sediments into the stream and alter habitat quality. All extant sites in the Black River drainage resulted from past reintroduction efforts and we anticipate future reintroductions within these sites during the period covered by this consultation. We thus consider these sites occupied for the purposes of this BCO.

The Concho Bill/Deer Creek proposed critical habitat unit includes 17 acres of ASNF lands. It is proposed as critical habitat because it is essential for the conservation of the species. PBF #1 is present. Included in the critical habitat proposal is the spring at Concho Bill and a meadow-ephemeral stream reach extending for approximately 2,667 feet below the spring. This is an isolated population that was established through captive breeding and translocation of stock from Three Forks, also in recovery unit 6 in Arizona. Frogs were first released at the spring pool in 2000; subsequent releases have augmented the population. Whether the frogs persisted after that initial release is unknown. The population is small and generally only a few frogs if are detected during surveys. The primary threat is the limited pool habitat for breeding and overwintering, which thus far has limited the size of the population. Small populations are subject to extirpation

from random variations in demographics of age structure and sex ratio, and from disease and natural events. Crayfish are nearby in the Black River and could invade this site.

The 2011 Wallow Fire burned in the vicinity of the Concho Bill/Deer Creek proposed critical habitat unit and the damage to the unit from the fire itself, fire suppression activities, and post-fire runoff events is unknown. The other unit Arizona, the Campbell Blue and Coleman Creek unit, was also within the fire perimeter and was adversely affected as well.

## **B. Factors affecting the species' environment within the action area**

Physical habitat conditions in the Black River action area are the result of past and ongoing livestock management, forestry practices, wildfire control actions, recreational activities, and introduction of nonnative species including brown, brook, and rainbow trouts, and crayfish. The Three Forks population of Chiricahua leopard frogs has apparently been eliminated by crayfish that invaded the site beginning in 1993 (Fernandez and Rosen 1996). Crayfish are not yet known from the Concho Bill reintroduction site, but are in Boneyard Creek below Lake Sierra Blanca. Chytridiomycosis is not currently known from the Black River drainage.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native amphibian species. Additional discussions on the effects of nonnative stocked sportfish species to the Chiricahua leopard frog are in the Recovery Plan (USFWS 2007b). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition and disease transmission by the stocked sportfish species on Chiricahua leopard frog.

Effects to Chiricahua leopard frogs from the proposed stocking actions could occur if stocked sportfish or their progeny access the two reintroduction areas or if individual Chiricahua leopard frogs dispersing from those areas access the East Fork Black River. The Lake Sierra Blanca site flows into Boneyard Creek which is a tributary that is connected to the EFBR at Three Forks, which is upstream of the EFBR stocking site and downstream of Big Lake and Crescent Lake. Sportfish escapement from Crescent Lake is not expected, but Big Lake does on occasion spill and fish may escape at that time. Surveys of the Three Forks area in 2008 found six rainbow trout, five brook trout, two Apache trout (one mis-identified as a cutthroat trout), in addition to numerous brown trout (Robinson et al 2008). Four of the rainbow trout were found in the North Fork and two in Boneyard Creek. It is not known if these rainbow trout were hatchery fish or wild rainbow-Apache hybrids since that level of identification was not used. It is likely they were

wild hybrid trout because rainbow trout have not been stocked in the East Fork Black since 1996 and Big and Crescent lakes have not spilled since the early 1990s. Rainbow trout stocked into the EFBR in those years when Apache trout are not stocked would be present in the river for at least a few months, however, AGFD will only stock triploid rainbow trout here and these fish will not contribute to the wild rainbow trout population, so their effects would be limited in time. The escapement of stocked fish from Big Lake is functionally eliminated by the conservation measure for placement of a weir below the lake in those years when a spill may occur. This weir would trap all fish coming from the lake before they reached Chiricahua leopard frog habitat.

The five brook trout were all collected in Boneyard Creek, likely part of the self-sustaining population in that stream. The one Apache trout collected in Boneyard Creek was also a hatchery Apache trout, most likely from the East Fork Black River stocking area. This indicates that stocked trout from the EFBR stocking site do move upstream into Boneyard Creek and could encounter Chiricahua leopard frogs if they disperse from the lake into Boneyard Creek. If Chiricahua leopard frogs were breeding in Boneyard Creek, stocked trout could also encounter egg masses or tadpoles. The other four sites where Chiricahua leopard frogs were reintroduced in 2010 are also within dispersing distance to the EFBR stocking reach.

Successful establishment of Chiricahua leopard frogs at the six EFBR reintroduction sites would result in adult Chiricahua leopard frogs dispersing naturally from those sites to other potential habitat areas in the drainage. This natural movement pattern will put the dispersing individuals into areas where suitable habitats may not exist, or are occupied by predators such as trout. These dispersing individuals may or may not return to the site of origin. Dispersal has not been well-studied in the Chiricahua leopard frog. Dispersing individuals that locate suitable habitats may colonize those areas and, if enough areas are found, create a metapopulation. Alternatively, if sufficient suitable habitats are not found, dispersing individuals may die from a number of different causes including predation.

Runoff events after the Wallow Fire may have reduced nonnative fish populations in the East Fork Black River drainage, which could benefit the Chiricahua leopard frog if those populations (particularly of brown trout) do not recover to their previous levels. Future stocking into the East Fork Black River stocking site will focus on Apache trout, which are less predaceous than brown trout.

The Concho Bill proposed critical habitat unit is on Deer Creek, which joins the EFBR within the stocking reach. Deer Creek was fishless in surveys in 1996 and 1999 prior to introduction of Chiricahua leopard frogs. The site is 3.6 miles upstream from the confluence, within the five mile dispersal distance for Chiricahua leopard frogs. Rainbow trout or Apache trout have not been detected in the reintroduction site and proposed critical habitat and are unlikely to reach the site. Effects to PBFs of proposed critical habitat at this location from the proposed action are not expected to occur.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future

Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

All stocking sites in this complex are on the ASNF. Since the land within the action area is managed by a Federal agency; most activities that could potentially affect the species are Federal activities and subject to additional section 7 consultation.

Use of bait fish is illegal in the Black River, although waterdogs (tiger salamanders) are legal for use. It is unlikely that anglers pursuing stocked trout would use waterdogs as bait, so there is little incentive for these anglers to bring waterdogs to the site or attempt to establish populations in the vicinity for use.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

#### *Lower Verde River Complex*

### **Description of the Action Area**

As described in Table 3, there is one stocking site under consideration, stocked with rainbow trout. The action area is defined as the connected watersheds of the East Verde River above the Highway 87 crossing north of Payson.

#### **A. Status of the species and proposed critical habitat within the action area**

The natural Chiricahua leopard frogs population in Ellison Creek (a tributary to the East Verde River) was known in 1998 and re-discovered in 2006 but frogs were not found there in 2007 or 2008 (Rorabaugh 2008). In 2009, Chiricahua leopard frogs were stocked into four sites in the Ellison and Lewis creek areas and additional stockings were done in August, 2010. These sites are several miles away from the stocking sites; however, a new reestablishment site for 2010, Pieper Spring at the old Pieper Spring Hatchery, is approximately 100 meters upslope of the river, and is two miles above the most upstream rainbow trout stocking site. Wild rainbow trout are present in the river below the spring, but cannot access the area where Chiricahua leopard frogs were stocked.

The Ellison/Lewis Creek proposed critical habitat unit includes 83 acres of Tonto National Forest lands and 15 acres of private lands. It is proposed as critical habitat because it is essential for the conservation of the species. PBFs #1 and 2 are present. Included in the critical habitat proposal are potential breeding sites at Moore Saddle Tank #42, Ellison Creek just east of Pyle Ranch, Lewis Creek downstream of Pyle Ranch, and Low Tank. Intervening drainages that provide connectivity among the latter three sites are also proposed as critical habitat as follows: unnamed tributary to Ellison Creek from its confluence with an unnamed drainage downstream to Ellison Creek, then directly west across the Ellison Creek floodplain and over a low saddle to Lewis Creek below Pyle Ranch, then downstream in Lewis Creek to its confluence with an



unnamed drainage, and then upstream in that unnamed drainage to Low Tank. Moore Saddle Tank #42 is about 0.8 mile overland from Low Tank; hence, it is within the one mile overland distance for reasonable dispersal likelihood; however, there are four drainages that bisect that route, and it is likely that any Chiricahua leopard frogs traversing those uplands would move down or upstream in one of those drainages rather than crossing them. As a result, Moore Saddle Tank #42 will be managed as an isolated and potentially robust population. This leaves the other sites one short of the four needed to form a metapopulation; however, no other sites in the area are known that contain the PBFs or have the potential for developing the PBFs. Additional exploration of the area and likely some habitat renovation will be needed to secure a fourth site. Chiricahua leopard frogs have occasionally been found in Ellison Creek – small numbers of frogs were found in 1998, but were not seen again until 2006. Despite intensive surveys, no frogs were found in 2007 or 2008. Whether this unit was occupied at the time of listing is unclear. In 2009, egg masses from Crouch Creek in Unit 24 were headstarted and tadpoles and young frogs were stocked at the four sites listed above as potential breeding sites. Frogs from those releases appeared to be doing well at all four sites in 2010. Additional releases of Crouch Creek frogs occurred in July 2010.

## **B. Factors affecting the species' environment within the action area**

Physical habitat conditions in the East Verde River action area are the result of past and ongoing livestock management, forestry practices, wildfire control actions, recreational activities, and introduction of nonnative species including brown, brook, and rainbow trouts. The cause of the disappearance of Chiricahua leopard frogs from this portion of its range is unclear but the threats identified above, in combination were likely contributing factors. Chytridiomycosis is not currently known from the East Verde River drainage.

## **EFFECTS OF THE ACTION**

The proposed action has 32,000 rainbow trout stocked into the East Verde River from the pumphouse down to the Highway 87 bridge crossing at 11 sites from April to August. There are other nonnative fish present in the stocking reach, including wild rainbow trout. The portion of the East Verde River above the pumphouse is managed as a wild rainbow trout fishery and is not stocked.

The stocked rainbow trout can move up Ellison Creek through the 1.2 mile perennial lower reach (from the East Verde River to Perley Creek) but cannot directly access the Chiricahua leopard frog stocking sites since the creek is ephemeral upstream of that and does not become perennial again until near Ellison Creek Estates (approximately three to four miles). On the mainstem East Verde River, there is a low-flow fish barrier at the Forest Boundary and private lands below Rim Trails Estates. At high flows during spring runoff or heavy monsoon storms, fish could make it upstream past the barrier. Only one stocking site, pumphouse, is above the barrier, so the number of stocked trout present over the course of the stocking season is a fraction of the total effort. The Chiricahua leopard frog habitat is in ponds not directly connected to the river and any stocked rainbow trout would not be able to access Chiricahua leopard frog proposed critical habitat.

Chiricahua leopard frog stocked in the Ellison and Lewis creek areas are within the five mile dispersal area for movements down drainages; however, during the summer months, the ephemeral reach of the creek may be a partial barrier for downstream movements by Chiricahua leopard frog. There is an opportunity for predation on Chiricahua leopard frog that reach the EVR from Ellison Creek but few frogs would be anticipated to reach the river.

The stocking site at Pieper Spring has a much greater opportunity for Chiricahua leopard frog to disperse into the stocking reach and be exposed to stocked rainbow trout. There is perennial flow from the Chiricahua leopard frog site to the pumphouse rainbow trout stocking area, and rainbow trout stocking would occur during the summer when Chiricahua leopard frog may be dispersing out of the reestablishment site. Chiricahua leopard frogs that move out of this site are also exposed to the wild rainbow trout population located in the river adjacent to the site. No stocked rainbow trout were documented in this area during surveys in 2009 (Gill 2009c).

Successful establishment of Chiricahua leopard frog at the reintroduction sites would result in Chiricahua leopard frog dispersing naturally from those sites to other potential habitat areas in the drainage. This natural movement pattern will put the dispersing individuals into areas where suitable habitats may not exist, or are occupied by predators such as trout. These dispersing individuals may return to the secure site; however, the behavior of dispersing Chiricahua leopard frog is poorly studied. Dispersing individuals that locate suitable habitats may colonize those areas and, if enough areas are found, create a metapopulation. Alternatively, if sufficient suitable habitats are not found, dispersing individuals may die from a number of different causes including predation.

Effects to PBFs of critical habitat from stocking rainbow trout in the East Verde River are unlikely to occur due to the restricted upstream access for rainbow trout to reach the critical habitat boundary in Ellison Creek. There is a reproducing population of rainbow trout in a portion of Ellison Creek (Burger 2006) near the proposed critical habitat that likely was established sometime in the past as a result of stocking into the watershed and not necessarily from stocking into the East Verde River itself.

## CUMULATIVE EFFECTS

All stocking sites in this complex are on the Tonto National Forest. Since the land within the action area is managed by a Federal agency; most activities that could potentially affect the Chiricahua leopard frog are Federal activities and subject to additional section 7 consultation.

Use of bait fish is illegal in East Verde River, although waterdogs (tiger salamanders) are legal for use. It is unlikely that anglers pursuing stocked trout would use waterdogs as bait, so there is little incentive for these anglers to bring waterdogs to the site or attempt to establish populations in the vicinity for use.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

*San Francisco Complex***Description of the Action Area**

This complex contains one site, Luna Lake, which would be stocked with rainbow and cutthroat trout. The action area is defined as the San Francisco River and associated wetlands from Luna Lake to the confluence with the Tularosa River below Reserve, New Mexico and including the Tularosa River drainage. This action area encompasses the area most likely to be affected by trout escaping Luna Lake that may also still support Chiricahua leopard frog.

**A. Status of the species and proposed critical habitat within the action area**

The last record for Chiricahua leopard frog at Luna Lake was in 1995. Chiricahua leopard frogs were reported in 2001-2002 from the San Francisco River near Reserve at The Box and Cave Creek and in 2002, 2006, and 2009 from North and South Forks of Negrito Creek. They are also extant on the upper Tularosa River between Hell Hole and Apache Creek. According to the recovery plan (USFWS 2007b), the populations at The Box and Cave Creek may be extirpated, and the 2002 survey in Negrito Creek found only one frog in what was once a robust population.

The Tularosa River proposed critical habitat unit contains 335 acres of Gila National Forest lands and 1,575 acres of private lands. It is proposed as critical habitat because it was occupied at the time of listing and currently contains sufficient PBFs to support life history functions essential for the conservation of the species. This is an approximate 19.31 mile reach of the Tularosa River in which frogs were observed in 2002 at the time of listing and continue to persist. It is isolated from other populations, but is a large system potentially capable of supporting a robust population. PBFs #1 and 2 are present. In 2009 small numbers of frogs were found at two sites in the unit. The frogs may occur throughout this reach of the river, but breeding is likely limited to isolated localities where nonnative predators are rare or absent. Crayfish are abundant, rainbow trout are present, and bullfrogs have recently been found downstream of the Apache Creek confluence and just below Hell Hole. Chytridiomycosis is present – the first Chiricahua leopard frogs to test positive for the disease in New Mexico (1985) were found at Tularosa Spring. The frogs were found at that site through 2005, but none have been observed since. A robust population was present nearby at a pond in a tributary to Kerr Canyon, in Kerr Canyon, and at Kerr Spring, but experienced a die-off from chytridiomycosis in 2009; it is unknown if frogs persist in that area. Chytridiomycosis is considered a serious threat in this unit. Both bullfrogs and crayfish are relatively recent arrivals in this system and limit, but thus far have not precluded, recovery opportunities. The proposed critical habitat does not extend much below Hell Hole because of a lack of recent frog observations in that reach, presumably due to prevalence of nonnative species and disease. Chiricahua leopard frogs occurred in the 1980s in this lower reach but have not been observed since.

The Long Mesa, Cullum, and Burro tanks/North and South forks of Negrito Creek proposed critical habitat unit consists of 408 acres of Gila National Forest lands and 102 acres of private lands. It is proposed as critical habitat because it was occupied at the time of listing and currently contains sufficient PBFs to support life history functions essential for the conservation of the

species. PBFs #1 and 2 are present. Included as proposed critical habitat are three livestock tanks (Long Mesa, Cullum, and Burro tanks) in the Deep Creek Divide area and connecting reaches of North and South Fork of Negrito Creek above their confluence. Long Mesa Tank is currently occupied; single surveys in 2010 did not find frogs at Cullum Tanks or the North Fork of Negrito Creek, although Chiricahua leopard frogs occupied these sites in 2009. Frogs were last found in South Fork of Negrito Creek in 2006 and at Burro Tank in 2002. Four impoundments on private lands along South Fork of Negrito Creek have not been surveyed for frogs; however, it is presumed they serve or once served as habitat for Chiricahua leopard frogs. Long Mesa, Cullum, and Burro tanks, and South Fork of Negrito Creek were occupied at the time of listing. All sites are thought to retain the PBFs. Also included in the proposed critical habitat are intervening drainages and uplands for movement among these breeding sites as follows: 1) From Burro Tank downstream in Burro Canyon to Negrito Creek, then upstream in Negrito Creek to the confluence of South Fork and North Fork of Negrito Creek, 2) from Long Mesa Tank overland and east to Shotgun Canyon, then downstream in that canyon to Cullum Tank, and 3) from Cullum Tank downstream in Shotgun and Bull Basin canyons to an unnamed drainage, then upstream in that drainage to its confluence with a minor drainage coming off Rainy Mesa from the east-northeast, then upstream in that drainage and across Rainy Mesa to Burro Tank. Populations in this unit have suffered from chytridiomycosis. A complex of tanks, springs, and streams in the Deep Creek Divide area was once a stronghold for the Chiricahua leopard frog on the Gila National Forest. However, most of those populations contracted the disease, suffered die-offs, and disappeared. Frogs on the North Fork of Negrito Creek were few in number and appeared sick in 2008. Their possible absence in 2010 may be a result of a disease-related die off. Presence of the disease compromises PBF #1 and limits recovery opportunities in this unit.

## **B. Factors affecting the species' environment within the action area**

Physical habitat conditions in the San Francisco River action area are the result of past and ongoing livestock management, forestry practices, wildfire control actions, recreational activities, and introduction of nonnative species including brown, brook, and rainbow trouts. Chytridiomycosis is also present in this area and is a primary threat in the New Mexico portion of the San Francisco River drainage. The cause of the disappearance of Chiricahua leopard frog from this portion of its range is unclear but the threats identified above, in combination were likely contributing factors.

## **EFFECTS OF THE ACTION**

Impacts to Chiricahua leopard frogs from stocking rainbow and/or cutthroat trout into Luna Lake are related to trout potentially escaping Luna Lake during times of the lake spilling (snow melt, monsoonal discharges, or from irrigation water releases through the headgate in the dam during summer months) and potentially moving downstream in the San Francisco River to occupied Chiricahua leopard frog habitats in that river, the Tularosa River, and North and South forks of Negrito Creek.

Rainbow trout fishing is reportedly good between Luna, New Mexico and the Arizona stateline, as well as at the Frisco Box a few miles downstream of that. Cutthroat trout have not been documented in any surveys in the action area outside of Luna Lake. No trout are legally stocked

in the San Francisco River in New Mexico, so the origin of these trout is unknown and some may originate in Arizona from Luna Lake. Wild rainbow trout are also found in the Tularosa River, and rainbows and rainbow-Gila hybrids are reported from South Fork of Negrito Creek and the mouth of North Fork of Negrito Creek, which in some years have some of the best trout fishing on the Gila National Forest (Johnson and Smorynski 1998). Rainbow trout in these systems are not supported by current stocking actions in New Mexico, and are most likely wild fish with self-sustaining populations. Based on the physical information about the reach of the San Francisco River from Luna Lake to occupied Chiricahua leopard frog habitat, including the distances involved, the likelihood of rainbow trout from Luna Lake supporting or augmenting the wild trout populations in Chiricahua leopard frog habitat is doubtful, and adverse effects to frogs or proposed critical habitat in the Tularosa River or Negrito Creek units is unlikely to occur since we do not expect stocked trout from Luna Lake to reach these areas. However, as a conservation measure in the CAMP, AGFD will share information with the New Mexico Department of Game and Fish (NMDGF) on salmonid populations in occupied habitats to continue to assess this issue.

## CUMULATIVE EFFECTS

Luna Lake is on the Apache National Forest. Recreational facilities and the concession are managed or licensed by the Forest Service. Watershed activities are also managed by the Forest Service. Water releases from the lake are managed by the Luna Irrigation Company (which owns most of the water rights outside of a minimum pool right owned by AGFD). Below the lake along the San Francisco River, some of the land is on the Apache and Gila National Forests, with private significant private inholdings concentrated at the towns of Luna and Reserve and on the Tularosa River and portions of Negrito Creek. Watershed management is primarily by the Forest Service, with local water use and development activities on private lands subject to limited Federal involvement.

Use of live baitfish at Luna Lake is prohibited, however, waterdogs are allowed. Fathead minnow and waterdogs are found in the lake, the initial sources of these species are unknown; however, fathead minnows are also found in the river below the lake as far downstream as Glenwood (Propst et al. 2009). There is no impetus to establish live bait populations for use in Luna Lake to pursue stocked trout.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

### *Tonto Creek Complex*

#### **Description of the Action Area**

The Tonto Creek action area contains three stocking sites; Christopher Creek, Haigler Creek, and Tonto Creek. Rainbow trout is the only species proposed for stocking during April through October. Tonto Creek is stocked from April through October with 16,000 trout; Christopher Creek is stocked from April through October with 10,000 trout. Haigler Creek is stocked from

April through August with 16,000 trout; however, effects to Chiricahua leopard frog from stocking in Haigler Creek is much less likely due to the distance Chiricahua leopard frog and stocked trout must move in order to encounter each other at Hells Gate downstream. The action area encompasses the headwaters of the three creeks and extends down Tonto Creek to Hells Gate. Rainbow trout records below Hells Gate are limited, with only one rainbow trout found downstream from that area to near Gisela. Water temperatures below Hells Gate are too high to allow persistence of rainbow trout much below this point.

#### **A. Status of the species within the action area**

The natural Chiricahua leopard frog populations in the upper Tonto Creek drainage are extirpated; the last record for a Chiricahua leopard frog was from near Indian Garden Spring in 1997. Chiricahua leopard frogs were reestablished in sites at Big Canyon and Cabin Draw in August, 2010. These two drainages join Tonto Creek in the upper portion of the stocking reach just below the Horton Creek confluence. As these sites are so recently established, their ability to persist is unknown. Wild brown and rainbow trout are present in Tonto Creek at and below the Chiricahua leopard frog drainages.

#### **B. Factors affecting the species' environment within the action area**

Physical habitat conditions in the Tonto Creek action area are the result of past and ongoing livestock management, forestry practices, wildfires and fire suppression, recreational activities, and introduction of nonnative species including brown and rainbow trouts. The cause of the disappearance of Chiricahua leopard frog from this portion of its range is unclear but the threats identified above, in combination were likely contributing factors. The role of chytridiomycosis in the status of the species in the Tonto Creek area is unknown, but no Chiricahua leopard frogs have tested positive for the disease in this region.

### **EFFECTS OF THE ACTION**

The two reestablishment sites are separated by at least one mile of ephemeral streambed from the perennial reach of Tonto Creek where rainbow trout would be stocked. Normal flow patterns in Tonto Creek have winter/spring runoff high flows, and a smaller summer monsoon peak. Chiricahua leopard frogs tend to be inactive between November and February so there is some potential for high flows in March or April to displace frogs downstream in the spring. At these elevations (5,400 feet and above), Chiricahua leopard frog activity may not begin until later in the spring, reducing the risk of adult but tadpoles may be more susceptible to winter displacement because they cannot swim as well in cold water. During the summer, flows in Tonto Creek are low except in the August-September monsoon season. This is also during the breeding period for the Chiricahua leopard frog, so eggs and tadpoles may also be displaced downstream if rainfall is sufficient in the ephemeral drainages to create flow. Adult and dispersing frogs would not need significant amounts of water to move downstream to Tonto Creek, so it is more likely they would be exposed to stocked rainbow trout. The confluence with Christopher Creek is downstream of Horton Creek and within the five mile dispersal distance for Chiricahua leopard frog.

Stocked rainbow trout are not likely to access the Chiricahua leopard frog stocking sites except, possibly, during summer monsoon flows. These flows tend to be rapid and of short duration, but there is a potential for limited connectivity. Unless the individual trout could make it all the way up to the reestablishment sites during the period when flow is present, it would not persist in the drainages due to lack of water.

Other potential predators of Chiricahua leopard frog are present as wild populations in Tonto Creek below the confluence with the reintroduction streams. Brown trout are significant predators and as a wild population, are used to foraging for food, unlike most hatchery reared trout.

Successful establishment of Chiricahua leopard frog at the two reintroduction sites would result in adult Chiricahua leopard frogs dispersing naturally from those sites to other potential habitat areas in the drainage. This natural movement pattern will put the dispersing individuals into areas where suitable habitats may not exist, or are occupied by predators such as trout. These dispersing individuals may return to the secure site; however, behavior of dispersing Chiricahua leopard frogs is poorly studied. Dispersing individuals that locate suitable habitats may colonize those areas and, if enough areas are found, create a metapopulation. Alternatively, if sufficient suitable habitats are not found, dispersing individuals may die from a number of different causes including predation.

#### CUMULATIVE EFFECTS

All stocking sites in this complex are on the Tonto National Forest. Since the land within the action area is managed by a Federal agency; most activities that could potentially affect the Chiricahua leopard frog are Federal activities and subject to additional section 7 consultations.

Use of bait fish is illegal in Tonto Creek and its tributaries, although waterdogs (tiger salamanders) are legal for use. It is unlikely that anglers pursuing stocked trout would use waterdogs as bait, so there is little incentive for these anglers to bring waterdogs to the site or attempt to establish populations in the vicinity for use.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide Analysis discusses this effect in more detail.

#### *Santa Cruz River Complex*

##### **Description of the Action Area**

This complex contains three stocking sites of concern for Chiricahua leopard frog: Parker Canyon Lake, Patagonia Lake, and Peña Blanca Lake. Rainbow trout are the primary species to be stocked at three sites, with channel catfish, bluegills, and redear sunfish added at Parker Canyon Lake (Table 3). All stocking sites are located on different drainages within the Santa Cruz River basin, and will be described separately. For each site, the action area is the

hydrologically connected watershed for five miles around the stocking site, to accommodate the dispersal distance for Chiricahua leopard frog.

### Parker Canyon Lake

Parker Canyon Lake would be stocked annually with 45,000 rainbow trout from October through April and as needed to augment populations of channel catfish, bluegill and redear sunfish. Rainbow trout can carry over the summer in the lake due to cooler temperatures at depth, but do not spawn. The warmwater species are self-sustaining. Parker Canyon Lake spills to the south west toward the Santa Cruz River. There is about a mile of permanent water below the dam, and then the channel is ephemeral for 4.5 miles to another short (0.25 mile) perennial reach. The six miles to the Santa Cruz confluence is ephemeral. The perennial reach below the dam contains bullfrogs, crayfish, bluegill, green sunfish, and largemouth bass. No channel catfish have ever been found below the dam.

### **A. Status of the species and proposed critical habitat within the action area**

Chiricahua leopard frogs were recently reestablished into Scotia Canyon, a small drainage that does not confluence with the Parker Canyon drainage. There are historical records for Chiricahua leopard frogs in the vicinity of the lake; however, no Chiricahua leopard frogs have been documented in nearby stock tanks during Sonoran tiger salamander surveys.

The Scotia Canyon proposed critical habitat unit includes 70 acres and is entirely on Coronado National Forest lands. It is proposed as critical habitat because it is essential for the conservation of the species. The unit encompasses an approximate 1.36 mi (2.19 km) reach of the canyon with perennial pools, as well as a perennial travertine seep, a spring fed, perennial impoundment (Peterson Ranch Pond), and an ephemeral impoundment adjacent to Peterson Ranch Pond. There is also a perennial or nearly perennial impoundment in the channel downstream of the Travertine seep. Breeding habitat occurs at Peterson Ranch Pond and possibly at other perennial or nearly perennial pools. Chiricahua leopard frogs were reestablished in this canyon via a translocation in 2009; the last record of a Chiricahua leopard frog in the canyon before that was 1986. Scotia Canyon was not occupied at the time of listing. PBFs #1 and 2 are present. Currently, this site is isolated from other populations, the nearest of which is in Unit 15 about 4.4 miles straight-line distance away over mountainous terrain. Hence it is managed as an isolated population, but there is some potential for creating connectivity to the metapopulation in Unit 14 via population reestablishment in Garden Canyon at Fort Huachuca. Scotia Canyon, with its pond and stream habitats, has the potential to be a robust population. This canyon and sites around it has been the subject of intensive bullfrog eradication and habitat enhancement work in preparation for reestablishing the Chiricahua leopard frog. However, bullfrog reinvasion is a significant, continuing threat, and other nonnative predators could potentially reach Scotia Canyon via natural or human assisted immigration. Tiger salamanders (*Ambystoma mavortium*) from the Peterson Ranch Pond tested positive for chytridiomycosis in 2009; however, in 2010 the frogs appeared to be doing well in that same pond, and it is unclear as to whether tiger salamander have persisted at that pond. Nonetheless, disease has resulted in extirpations elsewhere in the Huachuca Mountains, and is considered a serious threat in Scotia Canyon. Heavy fuel loads could result in a catastrophic wildfire, which would have significant detrimental effects on the



frog and its aquatic habitats. A road through the canyon is eroded in places and contributes sediment to the stream; it receives much use by recreationists and U.S. Border Patrol. The proposed critical habitat designation for the Chiricahua leopard frog largely overlaps that of critical habitat for the endangered Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*). Several other listed and candidate species have been recorded in Scotia Canyon. These occurrences of critical habitat and listed species provide some level of protection to Chiricahua leopard frog habitat in this unit. This proposed critical habitat unit was not affected by the 2011 Monument Fire. However, since other proposed critical habitat units in the Huachuca Mountains and Santa Rita Mountains within this Recovery Unit were damaged during and after the fires, some very significantly, the importance of the Scotia Canyon unit to the conservation of the Chiricahua leopard frog in Recovery Unit 2 has increased.

### **B. Factors affecting the species' environment within the action area**

Nonnative species in the watershed have affected populations of Chiricahua leopard frog in the past. The reestablishment sites were renovated as needed to eliminate those nonnative predators.

#### **EFFECTS OF THE ACTION**

Sportfish stocked into Parker Canyon Lake cannot, on their own, access occupied Chiricahua leopard frog proposed critical habitat in Scotia Canyon, so effects to PBFs are not likely to occur. The perennial habitat for Chiricahua leopard frog in Scotia Canyon is approximately 1.5 miles, and, if Chiricahua leopard frog occupy the entire habitat, dispersing frogs could potentially access Parker Canyon Lake via Merritt or Scotia canyons with a short overland transit. Any Chiricahua leopard frogs that did reach the lake are subject to predation by channel catfish and other predators (largemouth bass, northern pike) in the lake. With the robust nonnative species populations, including bullfrogs and crayfish as well as fish, there is little to no opportunity for Chiricahua leopard frog to successfully colonize the lake or the perennial waters below the lake. Any Chiricahua leopard frog dispersing into these areas would likely be lost to predation. Bluegill and redear sunfish are new species to the stocking list; however, they are present in the lake as self-sustaining populations from past illegal stocking actions. Populations of these species may become depressed and AGFD may determine it is necessary to augment the population; however, the species would continue to be present in the lake without the augmentation, and the action would have little effect on restoration of population levels.

Rainbow trout that oversummer in the lake will have adapted to foraging for their own food, thus are potential predators on Chiricahua leopard frog eggs or larvae during times the lake is cool enough for them to be in the shallow waters around the lake edge. Rainbow trout reportedly occurred at Peterson Ranch Pond in Scotia Canyon in the late 1960s (T. Beatty, pers. comm. 2009). This pond is where Chiricahua leopard frogs were released in 2009. No trout exist there now, and the origin of these trout is unknown. Because of the location of the spring-fed pond on a hill above the creek, the only likely origin was a stocking.

#### **CUMULATIVE EFFECTS**

Parker Canyon Lake is on the Coronado National Forest. Since the land within the action area is

managed by a Federal agency; most activities that could potentially affect the CLF are Federal activities and subject to additional section 7 consultation.

Use of baitfish and waterdogs is prohibited at Parker Canyon Lake; however, anglers have continued to illegally use waterdogs as bait for warmwater species such as largemouth bass or northern pike. Neither of these fish species was legally stocked into the lake. Anglers bringing waterdogs into the area are also known to release them alive into other tanks or small waters. Tiger salamanders are a threat to Chiricahua leopard frog both as predators and as vectors for disease. *Bd*- and ranavirus-infected tiger salamanders have been detected in bait shops in Arizona (Picco and Collins 2008). In a survey of anglers that use tiger salamanders as bait, 67% of them claimed to release bait salamanders into the bodies of water they fished, even though such release is strictly prohibited by AGFD fishing regulations (Picco and Collins 2008). In their terrestrial form, tiger salamanders can disperse overland to other habitats, including those occupied by Chiricahua leopard frog. It is over four miles from Parker Canyon Lake to Chiricahua leopard frog occupied areas, so it is conceivable that released waterdogs could reach occupied habitats, although the degree of risk is potentially limited by the distance.

#### Patagonia Lake

##### **A. Status of the species within the action area**

Patagonia Lake would be stocked annually with 30,000 rainbow trout from November through March. Rainbow trout do not persist in the lake due to high summer temperatures. One rainbow trout was documented above the lake in the 1990s. Currently, there are no Chiricahua leopard frog in the vicinity of the lake; there is a record from 1987 upstream in Sonoita Creek a mile below the town of Patagonia, and Chiricahua leopard frog were found in 2000 at a site more than eight miles above the town. Stocking of rainbow trout into Patagonia Lake is unlikely to have any effect on Chiricahua leopard frog. There is no proposed critical habitat that could be affected by the proposed action at this location.

#### Peña Blanca Lake

Peña Blanca Lake would be stocked annually with 45,000 rainbow trout November through March. Rainbow trout cannot move far upstream out of the lake due to a barrier created by a concrete apron on Ruby Road (Highway 269) that forms a drop that would be difficult for trout to negotiate. But they can move downstream when the lake spills in the spring. Below the lake are a few pools that are too hot during the summer for trout to persist. Rainbow trout in the lake do not persist due to high water temperatures in the summer.

##### **A. Status of the species and proposed critical habitat within the action area**

Peña Blanca Lake is in the Alamo-Peña Blanca-Peck Canyons MA in RU 1. The status of the Chiricahua leopard frog in RU 1 and the threats to the species in this area is described in detail in the recovery plan (USFWS 2007b) and was updated in USFWS (2010c). This RU is the closest to achieving population recovery goals for CLF due to the robust metapopulation at Buenos Aires National Wildlife Refuge to the west and additional populations eastward toward and

around the lake and in the Sycamore Canyon region.

Peña Blanca Lake was renovated in 2008-2009 to remove mercury contamination and in the process, all fish were removed. A conservation effort for Chiricahua leopard frog was undertaken at this time, removing all bullfrogs from the area of the lake and surrounding tanks within a five mile radius. Chiricahua leopard frog from sites in this watershed colonized the lake in September, 2009 and successfully bred in the fall and again in the spring of 2010. Both Chiricahua leopard frog and lowland leopard frogs (*Lithobates yavapaiensis*) are currently breeding in the lake. Chiricahua leopard frogs also occur at several livestock tanks in the watershed of Peña Blanca Lake.

The Peña Blanca Lake proposed critical habitat unit includes 202 acres and is all on Coronado National Forest lands. PBFs #1 and 2 are present. It is proposed as critical habitat because it was occupied at the time of listing and currently contains sufficient PBFs to support life history functions essential for the conservation of the species. This unit is a metapopulation that includes Peña Blanca Lake, Peña Blanca Spring, Summit Reservoir, Tinker Tank, Thumb Butte Tank, and Coyote Tank. These sites were all occupied in 2009. Chiricahua leopard frogs and tadpoles were found in Peña Blanca Lake in 2010 and 2009 after the lake had been drained and then refilled, which eliminated the nonnative predators. However, in 2010, rainbow trout were restocked back into the lake, and a separate consultation to re-establish warmwater sportfish was completed in May, 2011. That proposed action includes conservation measures to reduce adverse effects from the warmwater stockings within the proposed critical habitat unit. Those conservation measures are not part of the proposed action under consideration in this BCO, but are discussed as relevant to the effects of rainbow trout stocking, which is part of this proposed action.

In 2002, Chiricahua leopard frogs were only known to occur at Peña Blanca Spring. Occupancy status at the time of listing for the other sites is unknown. Proposed critical habitat also includes: 1) From Summit Reservoir directly southeast to a saddle on Summit Motorway, then downslope to an unnamed drainage and downstream in that drainage to its confluence with Alamo Canyon, then downstream in Alamo Canyon to its confluence with Peña Blanca Canyon, then downstream in Peña Blanca Canyon to Peña Blanca Lake, to include Peña Blanca Spring, 2) from Thumb Butte Tank downstream in an unnamed drainage to its confluence with Alamo Canyon, 3) from Tinker Tank downstream in an unnamed drainage to its confluence with Alamo Canyon, then downstream in Alamo Canyon to the confluence with the drainage from Summit Reservoir, 4) from Coyote Tank downstream in an unnamed drainage to its confluence with Alamo Canyon, and then downstream in Alamo Canyon to the confluence with the drainage from Tinker Tank, to include Alamo Spring. Nonnative introduced predators, particularly bullfrogs and sportfish remain a serious threat in this region. A concerted effort was made in 2008-2010 to clear the area of bullfrogs. The effort appears to be successful and Chiricahua leopard frogs have benefited. However, there is a continuing threat of reinvasion or introduction. As discussed, sportfish at Peña Blanca Lake are an additional threat. Frogs in this region test positive for *Bd*; however, the disease appears to have little effect on population viability.

The Peña Blanca proposed critical habitat unit was entirely within the burn perimeter of the Murphy Fire. The eastern portion of the Sycamore Canyon unit was also within the burn perimeter. The extent of damage to the PBFs of proposed critical habitat in these units is

unknown at this time. Efforts to protect Peña Blanca Lake from runoff containing ash and sediments were initiated by the Coronado National Forest (CNF) and included placement of straw “wattles” around the lake to stop overland flows and flows coming down the tributaries. The conditions in the proposed critical habitat areas away from the lake are unknown at this time, and they may or may not be damaged by sediment inputs resulting from post-fire runoff.

## **B. Factors affecting the species’ environment within the action area**

Formal section 7 consultation was completed in March, 2010, for a rainbow trout stocking into the lake on March 23<sup>rd</sup>. The biological opinion for this stocking event (USFWS 2010c) discusses the effects of rainbow trout on ranid frogs in general, the risks of spreading *Bd* via stocking actions, and other details relevant to this consultation on the 10-year stocking of rainbow trout into the lake. This consultation was reinitiated in October, 2010, to allow for stocking of rainbow trout into the lake from November, 2010, to March, 2011 (USFWS 2010d). The proposal for stocking of warmwater sportfish in 2011 through 2013 was finalized in May, 2011 but stocking has not yet been initiated (USFWS 2011b).

In our BO on the warmwater sportfish stocking (USFWS 2011b), we examined the effects to the PBFs of proposed critical habitat at Peña Blanca Lake from the reintroduction of warmwater sportfish predators (particularly largemouth bass and channel catfish) to the lake. PBF #1g at the lake (presence of nonnative introduced predators occurring at a level that do not preclude presence of the Chiricahua leopard frog) was clearly affected by the reintroduction of these warmwater predators. However, we determined that the other five occupied sites proposed as critical habitat would not be directly affected, since the stocked fish species were not likely to reach them. There were indirect effects to PBF#1g at the other occupied sites related to the potential for the illegal introduction of bullfrogs (a significant predator on native frogs) to the lake by those wanting to use them as bait or desiring to establish a population for hunting. The conservation measures included in the proposed action for that consultation (these are listed elsewhere in this BCO) are designed to protect the occupied critical habitat sites and other potentially occupied tanks in the upper drainage from reinvasion by bullfrogs (all bullfrogs were removed from these tanks in 2009), thus maintaining the recovery value of those parts of the proposed critical habitat even in the event that Peña Blanca Lake might not be able to meet PBF#1g in the future due to the warmwater sportfish present. The overall value of this proposed critical habitat unit to support recovery was not impaired.

## **EFFECTS OF THE ACTION**

Rainbow trout feed primarily on emerging and terrestrial insects drifting in the water column, but are also known to take fish (Moyle 2002, Richard and Soltz 1986), and can be important predators on ranid tadpoles. Predation on tadpoles of mountain yellow-legged frogs can be heavy enough to singly, or in combination with other factors, eliminate the species from high mountain lakes in the Sierra Nevada of California (Bradford 1989, Bradford et al. 1993). Knapp and Mathews (2000) found negative effects of trout introductions at the landscape, watershed, and individual water body spatial scales. In Kings Canyon National Park and the John Muir Wilderness, introduced trout distribution was found to be negatively correlated with the distribution of the frog. At the watershed level, the total percentage of water bodies occupied by

fish was a highly significant predictor of occupancy by frogs. At the scale of individual water bodies, in fishless sites, frogs were three times more likely to be present and six times more abundant than in sites with fish. Furthermore, experimental removals of introduced trout have been followed by recovery of mountain yellow-legged frog populations (Knapp and Matthews 2000, Keisecker 2003). Knapp and Matthews (2000) evaluated the likelihood that other factors, such as disease, contaminants, and increasing UV-B radiation might be important factors in the observed declines of Mountain yellow-legged frogs. They concluded that introduced trout was the key factor in those declines, although these other factors might be contributing to declines, as well.

No studies have been conducted on the effects of introduced trout on the Chiricahua leopard frog. However, there is no reason to believe rainbow trout would not feed upon Chiricahua leopard frog tadpoles. Similar to the situation with the Mountain yellow-legged frog, the Chiricahua leopard frog occurred historically at a number of the large lakes in the Mogollon Rim region of east-central Arizona, but no longer occurs at these sites (e.g. Hawley Lake – 1967, Blue Lake – 1984, Horseshoe Lake – 1967, Blue Ridge Reservoir – 1972, Nelson Reservoir – 1971, Rainbow Lake – 1972, Tonto Lake – 1971, Baker lake – 1980, and Luna Lake ~1979; year shown is the last year Chiricahua leopard frogs were found). These lakes all contain introduced trout and in some cases other fishes and the last record of a Chiricahua leopard frog at any of these sites is 1984. With the exception of the situation today at Peña Blanca Lake, no Chiricahua leopard frogs are currently known to occur in lakes with trout. This is not definitive proof that trout cause extirpation of Chiricahua leopard frogs, but these observations provide evidence that trout may be a factor in the species' decline.

On the other hand, trout and Chiricahua leopard frogs apparently coexisted for some time at the species' type locality, Herb Martyr in the Chiricahua Mountains. However, the length of time the two persisted, or whether the population of frogs may have been a sink into which individuals immigrated from other populations, is unknown. Field notes of Dr. Richard Zweifel suggest that the frogs disappeared between 1974 and 1992; during the latter visit, Zweifel noted that the pond had largely filled in with gravel, although trout persisted in deeper pools below the dam. Whether predation by trout contributed to the demise of the frog at Herb Martyr is unknown.

Chiricahua leopard frogs and other leopard frogs can coexist with introduced predators in complex habitats that provide escape cover for frogs and tadpoles (USFWS 2007b). The difference between habitat conditions related to submerged cover (logs, submergent and emergent vegetation) and shoreline cover from vegetated banks in the Sierra Nevada Mountains lakes discussed above and that currently present in Peña Blanca Lake may be an important component in the effectiveness of rainbow trout predation. Information on shoreline cover availability was provided in at least Bradford (1989), Bradford et al. (1993), and Knapp et al. (2007) and universally described conditions where there was limited to no shoreline cover and submerged cover was sparse. These alpine lakes are also oligotrophic, and have simple food webs. Further, rainbow trout are established in these lakes, and are present during the entire active season for the mountain yellow-legged frog. Because of the limited growing season, mountain yellow-legged frog tadpoles usually require at least one overwintering as tadpoles before metamorphosis whereas Chiricahua leopard frog tadpoles can metamorphose in one year.

We would still expect that some Chiricahua leopard frog eggs and tadpoles would be lost to predation by stocked rainbow trout while the rainbow trout are present (the stocking season is November through March, and individual rainbow trout may persist until summer). In this recovery unit, Chiricahua leopard frogs reproduce primarily from February to June, with some breeding into late summer and early fall (USFWS 2007b). Active rainbow trout stocking overlaps with the first two months of the breeding season, with some level of rainbow trout survival through at least June. The majority of the stocked rainbow trout (27,000 fish assuming an even distribution of the 45,000 fish over the five month period) would be stocked prior to the breeding season and have been subject to capture and natural mortality attrition in numbers over that period. Surviving rainbow trout are likely to be feeding on natural foods available in the lake, which can include eggs and tadpoles.

Although predation of tadpoles is expected, it is unlikely that stocking rainbow trout would extirpate the frog from Peña Blanca Lake. The conditions in Peña Blanca Lake since it re-filled in 2010 were described in the rainbow trout stocking BO (USFWS 2010c) and the 2011 warmwater fish stocking BO (USFWS 2011b) and there is abundant submerged and shoreline cover for Chiricahua leopard frog egg masses and tadpoles available to reduce the vulnerability of these life stages to rainbow trout predation. Information from trout and frog studies in the Sierra Nevada of California indicate that the amount of shoreline and submerged vegetation and other types of cover such as logs is an important factor in the ability of tadpoles to avoid predation (Bradford 1989, Bradford et al. 1993, Knapp et al. 2007), and this is also noted in the Chiricahua leopard frog Recovery Plan (USFWS 2007b). The amount of shoreline and submerged vegetation at the lake provides escape cover for tadpoles and can act to reduce the amount of predation by the stocked trout. Currently, Peña Blanca Lake has this type of cover available, and the protection of that cover is part of the proposed action for stocking warmwater sportfish into the lake (USFWS 2011b) as a measure that might reduce the amount of warmwater fish predation on tadpoles and also reduce the amount of predation by rainbow trout. Further, rainbow trout are only seasonally present in the lake, and any tadpoles produced or surviving after the rainbow trout have died have the opportunity to survive and become adults.

PBF #1g (Nonnative crayfish, predatory fishes, bullfrogs, barred tiger salamanders, and other introduced predators absent or occurring at levels that do not preclude presence of Chiricahua leopard frog) could be affected by the stocking of rainbow trout in the Peña Blanca Lake portion of the proposed critical habitat as part of the proposed action. The rainbow trout are only present seasonally, and, with physical components of PBF #1 present in the lake, may not be able to preclude presence of Chiricahua leopard frogs through predation on tadpoles. Further, rainbow trout are not likely to access the five other occupied sites in the metapopulation that are also proposed for designation of critical habitat, so PBF #1g would not be affected in those locations and their ability to contribute to recovery of the species is not compromised. While this predation does affect recruitment of Chiricahua leopard frogs, the stocking of rainbow trout does not significantly impair the recovery value of the entire unit.

## CUMULATIVE EFFECTS

Peña Blanca Lake is on the Coronado National Forest. Since the land within the action area is

managed by a Federal agency; most activities that could potentially affect the Chiricahua leopard frog are Federal activities and subject to additional section 7 consultation.

Use of live baitfish is prohibited at the lake; however, anglers pursuing stocked largemouth bass or channel catfish can use waterdogs at the lake. Any release of live waterdogs is prohibited; however this does occur (Pico and Collins 2008) and subsequent contamination of tanks in the area supporting Chiricahua leopard frog may occur. To date, no tiger salamanders have been found at Peña Blanca Lake or nearby tanks, so this would represent the introduction of a novel predator. If *Bd* was introduced via tiger salamanders or stocked fish, it would not be a significant threat as the disease is already widespread in RU 1, but it appears to have little effect on population viability.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide Analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. Transport of the skin fungus *Batrachochytrium dendrobatidis* (*Bd*), the organism that causes chytridiomycosis through the act of stocking sportfish or by use of tiger salamanders as bait (see Picco and Collins 2008) is a considerable concern for the Chiricahua leopard frog. AGFD describes those protocols in the BA, and that information is incorporated here by reference. A full discussion on the potential for transporting *Bd* via the sportfish stocking program is included in the Area Wide Analysis section of this BCO.

As described in the area-wide analysis, illegal or inadvertent movement of unwanted aquatic organisms (including transmission of diseases and parasites associated with invertebrates, amphibians, or fish) between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. Currently, there is no legal baitfish use in Chiricahua leopard frog habitats, although use of waterdogs is allowed anywhere except a part of Santa Cruz County near Parker Canyon Lake. Crayfish may be taken alive from any water and used as bait in that water, but cannot be transported alive away from that water.

Cross border violation (CBV) activity has resulted in route proliferation, off-highway vehicle activity, increased human presence in backcountry areas, discarded trash, abandoned vehicles, cutting of firewood, illegal campfires, and increased chance of wildfire. Additionally, contamination of water sources, including stock tanks used for bathing or waste disposal is of concern for the leopard frog.

#### CONCLUSION

After reviewing the current status of Chiricahua leopard frog, the environmental baseline for the action areas, the effects of the proposed stocking actions and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species. No critical habitat has been designated for this species, therefore, none

will be affected.

We present this conclusion on the Chiricahua leopard frog for the following reasons:

- Adverse effects to natural Chiricahua leopard frog populations in the San Francisco River and tributaries near Reserve, New Mexico, are not likely to occur. Information suggests that the rainbow trout populations may be self-sustaining or rely on inflow from nearer populations. No effects to proposed critical habitat are expected to occur from stocking at Luna Lake.
- Adverse effects to Chiricahua leopard frog in reestablishment and natural populations in the Black River, East Verde River, Tonto Creek, and Parker Canyon Lake are expected to occur if dispersing Chiricahua leopard frogs move out of the secure habitats and into stream reaches containing stocked trout species or, in the case of Parker Canyon Lake, channel catfish and sunfishes. Successful establishment of populations in secure reestablishment sites would lead to larger numbers of Chiricahua leopard frogs leaving the area to locate new habitats, with a concomitant increase in potentially adverse interactions with stocked fish or other dangers. However, these losses do not impinge on the success of the reintroduced population in the secure area, so these effects are not significant. No effects to proposed critical habitat at these stocking sites are expected to occur.
- Adverse effects to the metapopulation around Peña Blanca Lake from the stocking of rainbow trout are not likely sufficient to eliminate Chiricahua leopard frogs from the lake since the trout are not present through the entire Chiricahua leopard frog breeding season and the amount of cover in the lake provides protection for egg masses and tadpoles. While the presence of rainbow trout may conflict with maintaining PBF#1g in the lake while the trout are present, we do not believe that the seasonal presence of rainbow trout results in enough predation that PBF#1g is compromised to the extent that Chiricahua leopard frogs would be unable to maintain a presence at the lake.
- The risks of contamination of Chiricahua leopard frog sites with *Bd*, waterdogs, and other nonnative aquatic species, diseases, or parasites due to stocking actions and angler pursuit of stocked sportfish exist and procedures to reduce the risk cannot entirely eliminate it. For the sites considered in this analysis, under the current environmental baseline, this risk is not significant except at Peña Blanca Lake where a metapopulation may be forming in the watershed. Additional consideration of these issues is provided in the Area Wide analysis in this BCO.
- Effects to PBFs of proposed critical habitat from the proposed action are only likely to occur at Peña Blanca Lake, and are not likely to significantly reduce the recovery value of the entire unit since it represents only one of the six sites in the metapopulation and the lake located at one apex of the connected unit apart from the other sites, thus connectivity for dispersal between the other five occupied sites is not impaired by the presence of rainbow trout in the lake. Further, the recovery value of the Peña Blanca Lake portion of the unit may have already been compromised by approval to stock warmwater sportfish



at the site. Under the conservation measures included in the 2011 BO on that stocking, the remainder of the proposed critical habitat unit would be monitored for nonnative species and management actions taken as needed to protect PBF#1g.. The stocking of rainbow trout into the lake has no additive risk to the PBFs found in the rest of the unit over that resulting from the previous consultation on warmwater sportfish stocking.

- There are additional effects to Chiricahua leopard from new species included in the proposed action at the East Fork Black River and Parker Canyon Lake. As discussed in the Effects of the Action section, these additional effects do not significantly increase the total level of effects from that carried forward by the continuing stocking actions in the proposed action.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by WSFR so that they become binding conditions of any grant or permit issued to the (applicant), as appropriate, for the exemption in section 7(o)(2) to apply. WSFR has a continuing duty to regulate the activity covered by this incidental take statement. If the WSFR (1) fails to assume and implement the terms and conditions or (2) fails to require the AGFD to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WSFR or AGFD must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

### **AMOUNT OR EXTENT OF TAKE**

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- East Fork Black River, East Verde River, and Tonto Creek: for Chiricahua leopard frog to be present, they must disperse from the reintroduction sites to the stocking sites. If the populations do establish, it is likely that individual juvenile or adult Chiricahua leopard frogs would move downstream toward the stocking sites, thus meeting the first condition for species to be present. Once at the stocking sites, the juvenile and adult Chiricahua leopard frogs are exposed to stocked rainbow trout and wild populations of rainbow and brown trout. The stocked rainbow trout are less likely to be active predators on Chiricahua leopard frog than the resident wild trout populations. We are unable to be reasonably certain that any predation on Chiricahua leopard frog would be the result of the proposed action, thus cannot meet the second condition.
- Luna Lake and Patagonia Lake: Chiricahua leopard frogs are not likely to be present at these sites so the first condition is not met. Effects from stocking at these sites are not likely to occur, thus not meeting the second condition.
- Parker Canyon Lake: for Chiricahua leopard frog to be present, they must disperse from the currently occupied sites above the lake to the stocking site. It is possible that individual juvenile or adult Chiricahua leopard frogs would move downstream toward the stocking site, thus meeting the first condition for species to be present. Once at the stocking sites, the juvenile and adult Chiricahua leopard frog are exposed to stocked rainbow trout, channel catfish, and wild populations of other predators (largemouth bass, northern pike) in the lake. The stocked rainbow trout are less likely to be active predators on Chiricahua leopard frog than any of the other predators, and there are already channel catfish present in the lake. We are unable to be reasonably certain that any predation on Chiricahua leopard frog would be the result of the proposed action, thus cannot meet the second condition.

The AESO anticipates that an unknown number of tadpoles in Peña Blanca Lake during the residence time of the stocked rainbow trout will be incidentally taken as a result of this proposed action in each year. The incidental take is expected to be in the form of harm resulting from predation on tadpoles by the stocked rainbow trout. The number of tadpoles taken each year will vary depending on a number of factors including: the number of tadpoles of suitable size present in the lake during the period when stocked rainbow trout are present, the amount of cover or other physical habitat factors in the lake that influences the ability of the stocked rainbow trout to locate tadpoles, the rate at which individual stocked rainbow trout are removed from the lake by angling or natural mortality post-stocking, and other biological or physical factors not related to the stocking of rainbow trout that influence the survival of tadpoles during the residence period of rainbow trout. The complexities of tadpole survival in the wild without the added stressor of

stocked rainbow trout do not allow us to formulate a precise level of incidental take, so for this consultation, we use the worst-case scenario that in any year, all tadpoles present in Peña Blanca Lake during the residence time of the stocked rainbow trout will be taken. We do not expect this to be the case in all years owing to the factors discussed above, with the presence of escape cover a significant factor in providing for tadpole survival in any given year. With the level of anticipated take, there are no exceedence criteria provided, so incidental take cannot be exceeded under the review requirement.

#### EFFECT OF THE TAKE

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

#### REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS (as appropriate)

The 2011 warmwater sportfish stocking BO contained a mandatory conservation measure to protect naturally occurring shoreline and submerged vegetation to provide escape cover for Chiricahua leopard frogs in Peña Blanca Lake to assist in maintaining the reproducing population of frogs there despite the presence of predatory warmwater sportfish. This measure also provides for minimizing the amount of potential take from rainbow trout stocking under this proposed action, and serves as the reasonable and prudent measure and terms and conditions to address take from this proposed action.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. WSFR, using information provided by AGFD, must immediately provide an explanation of the causes of the taking and review with the AESO the need for possible modification of the reasonable and prudent measures.

#### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care and in handling dead specimens to preserve the biological material in the best possible state.

#### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for Chiricahua leopard frog contingent upon CAMP funding availability as described in the Program document. The ability to implement recovery actions for Chiricahua leopard frog under the auspices of the CAMP provides conservation benefits to Chiricahua leopard frog that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### **Gila chub (*Gila intermedia*) and critical habitat**

#### **DESCRIPTION OF THE PROPOSED ACTION**

Gila chub may be affected by sportfish stocking actions in the Agua Fria River, Big Chino Wash, Middle Verde River, and Santa Cruz River complexes (Table 4). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 4: Stocking sites, sportfish species proposed for stocking, and potentially affected Gila chub populations and/or designated critical habitat. An (R) indicates a stocked conservation population.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking</b>           | <b>Gila chub population</b>                                                                                    | <b>Critical habitat unit</b>                                                                                   |
|------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <i>Agua Fria River</i>       |                                                |                                                                                                                |                                                                                                                |
| Fain Lake                    | ONMY, ONCL, SAFO, SATR, LEMA, MISA, POAN, ICPU | Little Sycamore Creek<br>Sycamore Creek<br>Indian Creek<br>Silver Creek<br>Larry Creek (R)<br>Lousy Canyon (R) | Little Sycamore Creek<br>Sycamore Creek<br>Indian Creek<br>Silver Creek<br>Larry Creek (R)<br>Lousy Canyon (R) |
| Lynx Lake                    | ONMY, ONCL, SAFO, SATR, LEMA, MISA, POAN, ICPU | same                                                                                                           | same                                                                                                           |
| <i>Big Chino Wash</i>        |                                                |                                                                                                                |                                                                                                                |
| Granite Basin Lake           | LEMA, MISA                                     | Williamson Valley Wash                                                                                         | Williamson Valley Wash                                                                                         |
| <i>Middle Verde River</i>    |                                                |                                                                                                                |                                                                                                                |

|                         |            |                                  |                               |
|-------------------------|------------|----------------------------------|-------------------------------|
| Oak Creek               | ONMY       | Spring Creek                     | Spring Creek                  |
| Wet Beaver Creek        | ONMY       | Red Tank Draw<br>Walker Creek    | Red Tank Draw<br>Walker Creek |
| <i>Santa Cruz River</i> |            |                                  |                               |
| Rose Canyon Lake        | ONMY, SATR | Bear Canyon (R)<br>Sabino Canyon | Sabino Canyon                 |

#### Conservation measures included in the proposed action

In two years during the 10-year period, the AGFD shall survey the occupied Gila chub habitat on public lands in Spring Creek above the barrier when habitat conditions are conducive to rainbow trout persistence. If any stocked rainbow trout are found, these shall be documented and removed from the stream and an additional survey to locate stocked rainbow trout shall be implemented in the following year. The first survey will be completed within three years.

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild populations of Gila chub.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

AGFD will work with AESO and partners to develop and implement a recovery plan for the Gila chub. As part of that effort, conservation needs for the species relative to nonnative fish species will be identified and included in the plan (non-mandatory).

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

A Final Rule listing Gila chub as an endangered species was published Nov. 2, 2005 (70 FR 66664) (USFWS 2005a). Critical habitat was designated in 25 units totaling 258.1 km (160.3 mi)

within seven areas: the Agua Fria, Babocomari, lower San Pedro, lower Santa Cruz, middle and upper Gila, and upper Verde rivers. There is no recovery plan for this species.

#### Critical habitat

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species’ eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (see p. 4-34, U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

For Gila chub, we do not have a recovery plan that evaluates the role of each critical habitat unit for conservation of the species. For this analysis, we shall assume that any significant effects to the PBFs of any critical habitat unit could result in a loss of recovery value and thus have a negative impact on the potential recovery of the species in that critical habitat unit.

Critical habitat was designated for 25 stream reaches in the occupied range of the species. There are seven physical and biological features (PBFs), which include those habitat features required for the physiological, behavioral, and ecological needs of the species. These are:

- 1) Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas, generally of smaller tributaries;
- 2) Water temperatures for spawning ranging from 63 to 75 °F (17-24 °C), and seasonally appropriate temperatures for all life stages (varying from about 50 to 86 °F [10 °C to 30 °C]);

- 3) Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g. ranging from 6.5-9.5), dissolved oxygen (e.g. ranging from 3.0-10.0 ppm) and conductivity (e.g. 100-1000 mmhos);
- 4) Food base consisting of invertebrates (e.g. aquatic and terrestrial insects) and aquatic plants (e.g. diatoms and filamentous green algae);
- 5) Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of streambank stability, and a healthy, intact riparian vegetation community;
- 6) Habitat devoid of nonindigenous aquatic species detrimental to Gila chub or habitat in which detrimental nonindigenous species are kept at a level that allows Gila chub to continue to survive and reproduce; and
- 7) Streams that maintain a natural flow pattern including periodic flooding.

Of the 25 designated critical habitat units, six are in the vicinity of stocking sites and could be affected by the proposed action.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Gila chub. This information was taken from the final rule listing the species (USFWS 2005a), Weedman et al. (1996), Desert Fishes Team (2003), and the most recent Central Arizona Project biological opinion (USFWS 2008a). Information in these documents is incorporated by reference.

### *Life history*

Generally breeding is initiated with warmer water temperatures of 20 – 26.5 °C (68 – 79.7 °F). Gila chub prefers to spawn over submerged aquatic vegetation or root wads.

Griffith and Tiersch (1989) describe Gila chub as omnivorous. Rinne and Minkley (1991) identify that Gila chub feed on large and small aquatic and terrestrial invertebrates, and small fishes. Smaller individuals feed on organic debris, aquatic plants (especially filamentous algae), and diatoms (unicellular or colonial algae). Griffith and Tiersch (1989) found that Gila chub in Redfield Canyon consumed speckled dace (*Rhinichthys osculus*), dobsonfly nymphs (order Megaloptera), and terrestrial insects (i.e. ants, caterpillars, and beetles). A high presence of algae (diatoms), and small gravel (indicating bottom feeding) was also found to be present in their diet.

### *Habitat use*

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in artificial impoundments. Generally, Gila chub are often associated with cover including:

terrestrial vegetation, boulders, and fallen logs (Rinne and Minckley 1991) and undercut banks created by over hanging terrestrial vegetation (Nelson 1993). Habitat selection is lifestage-specific with adults commonly found in deep pools and eddies below areas with swift currents (Minckley 1973). Young-of-the-year inhabit shallow water among plants or eddies, and older juveniles use higher-velocity stream areas such as riffles (Minckley 1973). Dudley (1995) observed temporal variation in habitat selection in Sabino Canyon whereby Gila chub occupied dark interstitial spaces during winter and sub-adults were observed farther from cover and frequently in shallow areas or higher current areas during summer as water temperature warmed.

#### Current distribution

Gila chub populations remain extant in tributaries to the Agua Fria, Blue, Gila, San Francisco, Santa Cruz, and Verde rivers in Arizona and New Mexico. Populations are spread across the drainages, and most are isolated from other populations.

#### Threats

Primary threats to Gila chub survival include habitat loss. Deleterious activities include groundwater pumping, damming, diversions, and stream channelization, all leading to dewatering and alteration of channel morphology. In southeast Arizona poor watershed conditions due to overgrazing, mining, timber harvesting and fire suppression are identified as habitat threats (Bahre 1991; Humphrey 1985; Martin 1975). The Bureau of Land Management (BLM) (1998) suggested recreation (e.g. all-terrain vehicles, concentrated walking, stream hiking, wading, and swimming) may negatively affect habitat through increased sediment disturbance, fish displacement, and trampling bank vegetation. Destruction of stream habitat and dewatering lead to fragmentation of habitat and populations which in turn restricts movement, and reduces colonization and gene flow.

Perhaps the most serious threat to Gila chub is predation by and competition with nonnative organisms, including numerous nonnative fish species, bullfrogs, and virile crayfish. The impacts of nonnative fish species on native fish including Gila chub have been well documented (Hubbs 1955, Miller 1961, Minckley and Deacon 1968, Minckley 1973, Meffe 1985, Minckley 1985, Moyle 1986, Williams and Sada 1985, Minckley and Deacon 1991, Ruppert et al. 1993, Clarkson et al. 2005).

#### Conservation actions

Conservation measures under the Gila River Basin Native Fishes Conservation Program for the Gila chub include barrier construction and renovation of streams to remove nonnative species and reintroductions into the historical range.

#### *Previous consultations*

Section 7 consultations on Gila chub in Arizona and New Mexico include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts



that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Gila chub in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

There are five disjunct drainages supporting Gila chub that may be affected by the proposed stocking of sportfish. Each stocking complex is discussed separately below.

#### *Agua Fria Complex*

##### **Description of the Action Area**

The Agua Fria Complex contains two stocking sites that may have effects to Gila Chub. The action area is defined as Lynx Creek, including Lynx Lake and Fain Lake to its confluence with the Agua Fria River, and the Agua Fria River to its crossing of Interstate 17 near Black Canyon City including the portions of Little Sycamore Creek, Indian Creek, and Silver Creek that can be accessed from the river. This area encompasses the area of potential exposure of Gila chub to sportfish species that may exit Lynx and Fain Lakes.

##### **A. Status of the species and critical habitat within the action area**

Gila chub are present in six populations in tributaries to the Agua Fria River; one is stable-threatened (Little Sycamore), two conservation populations are unknown status but believed to be persisting (Larry Creek, Lousy Canyon) and three are unstable-threatened. Individuals from any of these six populations may be displaced from the occupied habitats in the tributaries to the mainstem Agua Fria. In the case of Silver Creek, Gila chub are usually found in the creek from below the waterfall barrier approximately 2.5 miles above the confluence with the Agua Fria River. There is also a barrier on upper Sycamore Creek, but none on Little Sycamore Creek or Indian Creek, although the lower portion of Indian Creek is ephemeral which acts as a barrier during portions of the year.

Nonnative fish species are present in the Agua Fria River, particularly green sunfish, mosquitofish, and bullhead. These species can move upstream toward occupied Gila chub habitats in Sycamore Creek, Silver Creek, and Indian Creek. Nonnatives cannot move above the barrier in Silver Creek, and the lower portions of Sycamore and Indian creeks are ephemeral, so movements can only occur during runoff events. Gila chub below the barrier on Silver Creek are exposed to these nonnatives, and recruitment of Gila chub is apparently not successful here due

to the presence of green sunfish. As noted in the listing document (USFWS 2005a), green sunfish and Gila chub cannot coexist. Largemouth bass are also a threat, and the illegal introduction of this species into Monkey Springs is considered responsible for the elimination of that Gila chub population (Minckley 1973).

The only critical habitat unit that could be accessed by stocked sportfish is Indian Creek. This unit is 8.4 km (5.2 mi) long and represents 20 percent of the 41.2 km (24.6 mi) of critical habitat present in the Agua Fria drainage. It contains one or more of the PBFs, including perennial pools and vegetation cover. Portions of the unit are intermittent. There is no barrier between the Agua Fria River and the critical habitat boundary which is located approximately five miles upstream of the confluence and the lower two miles of this reach has only subsurface flow (Weedman et al. 1996). Nonnative fish species were not documented in this unit in 1995 when the Gila chub were found here (Weedman et al. 1996). In the post-fire salvage operation in 2005, only native fish were reported as present (Cantrell 2005a) and this was confirmed by Clarkson et al. (2010).

### **B. Factors affecting the species' environment and critical habitat within the action area**

Livestock grazing and other land management actions are controlled by the Prescott National Forest and BLM. The Cave Creek Fire in July 2005 burned in the watersheds supporting Gila chub. Individuals from Sycamore Creek, Indian Creek, and Silver Creek were salvaged and held offsite, and returned in August (Silver Creek) and November (Indian Creek). While immediate post-fire surveys did not document significant runoff damage (Cantrell 2005a), post-fire runoff resulted in large sediment loads entering the creeks, particularly in Indian Creek. The habitat in these creeks is largely gone, and efforts to restore the area are in the planning process. This has affected the PBFs 1-5, and 7, and has significantly reduced the value of critical habitat to meet conservation needs for the Gila chub.

We believe that the aggregate effects of past management actions and the 2005 Cave Creek Fire is responsible for the current status of Gila chub in the action area.

### **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the Gila chub are in the final rule (USFWS 2005a). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition and hybridization by the stocked sportfish species on Gila chub.

When Lynx Lake spills periodically, stocked sport fish are likely transported downstream to Fain Lake. For example, trout were documented in Fain Lake before AZGFD first stocked them there in 1997. Lynx Creek flows about 10 miles to the Agua Fria River, which is intermittent for about 22 miles to the reach where it meets Sycamore Creek, and approximately eight and nine miles respectively further downstream to Indian and Silver Creeks. Sycamore Creek is also intermittent about 6 miles upstream to its confluence with Little Sycamore Creek. Both Lynx Creek and the Agua Fria River flow seasonally and during high precipitation events (Corkhill et al. 2001). During periods when water is released to meet water rights, stocked sport fish could be transported with the water diversion as it is pumped through the eight-inch release pipes. Stocked sport fish could also be washed over the spillway when the lake spills due to high inflows. Lynx Lake spilled in 1999, 2005, and 2007 as a result of spring runoff. The Lynx Lake spillway is approximately 60-feet high, thus fish escaping during spills must survive this drop to then move downstream. Runoff from Lynx Lake flows through two additional ponds downstream. AGFD reports that spills which exceed the capacity of this infrastructure to the extent that water is flowing through Lynx Creek all the way to the Agua Fria are rare.

USGS stream gauge data from near Mayer, Arizona (about 1 mile downstream of the Agua Fria confluence with Sycamore Creek), indicates that peak flow discharge can be over 30,000 cfs, and is over 5,000 cfs consistently in a 10-year period. Perhaps more importantly, during dry periods, there appear to be many flowing sections of the river between Lynx Creek and mouths of downstream tributaries that contain Gila chub. Weedman (2009) reported that, of seven spot-survey sites, five had flowing water, including the EZ Ranch site near the mouth of Sycamore Creek, and at the Mayer USGS gauge site. Given this information, it appears that there is a high probability that in high water years Lynx and Fain lakes likely spill and stocked sport fish can be transported downstream to areas of the Agua Fria River where they could access the mouths of tributaries that contain Gila chub. However, those same spot-check surveys did not document the presence of any stocked species of nonnative fish. As described earlier, Sycamore and Silver creeks contain barriers that may protect against upstream movement of nonnative fish, and Lousy Creek and Larry Canyon appear so isolated as to be well protected from upstream movement of fish. However, Indian Creek and Little Sycamore Creek, as well as downstream sections of Sycamore and Silver Creeks below waterfall barrier sites are accessible to nonnative fishes from the Agua Fria River in wet periods. However, the available data on fish distribution in these areas, while limited in temporal and spatial scope, have failed to detect or document the presence of any of the stocked species of fish in these areas, including the unprotected Indian and Little Sycamore creeks. Gila chub in Larry Creek and Lousy Canyon could be washed out of those sites by high flows to the Agua Fria River.

Stocked sportfish species most likely to have an adverse impact on Gila chub are channel catfish, largemouth bass, and white crappie; all of which are predators on small fish. Bluegills are also predators, however, at lower levels than the other species mentioned (Bonar et al. 2004). Although the trout species stocked into the lakes are also predators at varying levels, they are unlikely to survive in floodwaters sufficient to move them downstream to encounter Gila chub.

Fish surveys are limited in the Agua Fria River, and surveys immediately after high flow periods when fish could have been displaced from the lakes are lacking. Holycross et al. (2006)

surveyed the Agua Fria for Northern Mexican and Narrow-headed garter snakes and found green sunfish, fathead minnow, common carp, red shiner, brown bullhead, and mosquitofish in the main river channel, and fathead minnow and green sunfish in Sycamore Creek near the Forest Service cabin, but did not document any stocked species. Likewise, AGFD has surveyed in the early nineties, and in 2001, 2005, 2008 and 2009, and did not find any of the stocked species (largemouth bass, bluegill sunfish, channel catfish and white crappie, rainbow, brook, brown or cutthroat trout), although rainbow trout have been found in Sycamore Creek and in the Agua Fria River at the mouth of Sycamore Creek in the past. It is likely these fish came from the wild population of rainbow trout in upper Sycamore Creek. Yellow bullhead, channel catfish, red shiner, mosquitofish, and common carp have only been documented in a few localities between Rock Springs to Lake Pleasant in the Agua Fria mainstem and these species are present in Lake Pleasant.

Hydrologic connectivity is often present although egress from Fain Lake is over a 60 foot fall onto bedrock and conditions for transport through the asphalt production areas downstream would be expected to be difficult for any fish species. However, hydrological connectivity, taken alone as a factor, could permit stocked fish to make the movement to areas occupied by Gila chub and Gila chub critical habitat. The Agua Fria near the confluence with Sycamore Creek may be perennial and there are intermittent flows at the Agua Fria near Indian and Silver creeks.

The Gila chub population most likely to be exposed to stocked sportfish is the one below the Silver Creek barrier. It is very unlikely that stocked sportfish would be able to ascend Sycamore Creek or Indian Creek to access Gila chub habitats there. Gila chub may be displaced downstream to the Agua Fria River from occupied habitats, where they may encounter nonnative fish species. Gila chub from Larry Creek and Lousy Canyon may also be displaced downstream. At the confluences with Larry Creek and Lousy Canyon, nonnative fish were present in the Agua Fria and this was discussed in the biological opinion for the introduction of Gila topminnow and desert pupfish to these streams (USFWS 1998a). The biological opinion concluded that individuals of these species that moved out of the introduction sites (which also support Gila chub) would be lost due to predation or competition with green sunfish and mosquitofish or other physical conditions in the river that would not support these native fishes.

As noted previously, Gila chub cannot coexist with green sunfish, largely because green sunfish are effective predators on young Gila chub. Green sunfish are likely present in the Agua Fria River in all perennial sections, and are believed to be preventing recruitment of Gila chub below the barrier in Silver Creek. As a result, only large adult Gila chub are present in this area. Any adult Gila chub that were displaced to the mainstem Agua Fria would be exposed to the extant green sunfish populations, and likely would not be able to reproduce. With the ephemeral nature of the lower portions of the streams and the barriers, it is unlikely that they could move back upstream once displaced. Any stocked sportfish reaching this area could be an additional predator on small Gila chub if they arrived or persisted during the spawning season; predation on adults would be unlikely unless the stocked sportfish were relatively large, since adult Gila chub can reach seven to nine inches.

Effects to critical habitat

The only potential effect to critical habitat in Indian Creek would be if stocked sportfish were to ascend the creek to reach the critical habitat boundary during the limited period of the year when water is flowing down to the Agua Fria River. Surveys in Indian Creek have not detected nonnative fish species that are present in the Agua Fria River (Weedman et al. 1996, Cantrell 2005a, Clarkson et al. 2010), so the likelihood of nonnative invasion from the Agua Fria River is unlikely to occur. For example, green sunfish are present in the Agua Fria River and this species is very capable at exploiting flow events to invade new territories and it has not reached Indian Creek (Moyle 2002, Stefferud and Stefferud 2007). With this information, we do not anticipate any effects to PBFs of critical habitat from the proposed action.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The mainstem corridor of the Agua Fria River is on BLM, state lands, and private lands. The lowest reaches of the occupied tributary streams are also on this land status mix. Activities on BLM lands are subject to section 7 consultation; those on state or private lands are not unless there is a Federal nexus. We are not aware of any significant non-Federal activities proposed for the action area.

Use of live bait fish is illegal at Lynx and Fain lakes; however, nonnative tiger salamanders can be used for largemouth bass at the lakes.

### *Big Chino Wash*

#### **Description of the Action Area**

Granite Basin Reservoir is on a tributary to Williamson Valley Wash. Largemouth bass and bluegill are proposed for stocking at this site. The action area extends from the lake downstream to the USGS stream gage on Williamson Valley Wash.

#### **A. Status of the species and critical habitat within the action area**

Gila chub are found on private lands in a perennial section of Williamson Valley Wash upstream of the USGS stream gage. Critical habitat extends 7.2 km (4.4 mi) from the gage upstream to where Williamson Valley Road crosses the wash. The entire section is in private ownership, and survey data is extremely limited. The status of this population is unknown. In 1990, Dave Gori with TNC surveyed pools and cienega-type habitat in Williamson Valley Wash and collected Gila chub (139+31 juveniles), longfin dace (79), fathead minnow(3) and green sunfish (1) (HDMS data). Williamson Valley Wash was again sampled in 1992 by Rob Bettaso and Allison Anderson to collect genetic samples for Dean Hendrickson at the University of Austin. The only fish reported from those collection attempts was Gila chub (however, collection of other species

was not reported/recorded) (Weedman et al. 1996). Weedman et al. (1996) believed the Gila chub's status was unknown in Williamson Valley Wash. Gila chub were detected there in June 2001 in an assemblage consisting of longfin dace, fathead minnow, mosquitofish, and bullfrogs (Bagley 2002), and in 2003 with longfin dace and mosquitofish and the final rule listed the population as "unstable-threatened". No surveys have been conducted since 2003 although some anecdotal information from 2005 indicated that populations had declined (USFWS 2005a).

The Williamson Valley Wash critical habitat unit is 22 percent of the total critical habitat length in the Verde River watershed and it is the most isolated of the four units. The critical habitat appeared to have all PBFs at the time of designation, and the primary nonnative species known to be of most concern to Gila chub, green sunfish, were not detected in any survey after 1990.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

The entire occupied habitat and critical habitat in Williamson Valley Wash is on private land. Water use for agriculture and residential purposes can affect the available habitat, and there are nonnative species present that can compete with or prey on Gila chub. Because access to the site is restricted by the landowner, we do not know the current status of the Gila chub population at this site, or the particulars of land management actions by the landowner that may be affecting the species.

#### **EFFECTS OF THE ACTION**

The USGS stream gauge data for Williamson Valley Wash indicates that the wash floods frequently, and often with large volumes of water. Mint Wash is a large tributary to Williamson Valley Wash; and, given its size and location, could be a significant source although there are other washes coming into Williamson Valley Wash from the south and west. The location of the USGS Williamson Valley Wash gauge does not enable us to parse out the origin of the flows reaching it; however, at large flow events likely all washes are contributing. Granite Basin Lake is a 2-acre large impoundment in the 50-year floodplain of Mint Wash on the Prescott National Forest that has filled with sediment such that it has lost about half its capacity since being dredged in 1993, and is now about 10-feet deep. The amount of sediment inflow to the lake indicates that there may be a considerable amount of runoff entering the lake, and with limited storage capacity, it likely spills on a regular basis, thus there is a reasonable possibility that Granite Basin Lake will spill over a 10-year period. Although neither of the species that are planned for stocking into Granite Basin Lake (largemouth bass and bluegill) has ever been found in the reach of Williamson Valley Wash occupied by Gila chub, there have only been 3 fish surveys of Williamson Valley Wash in the last 20 years. Of the stocked species, largemouth bass is an efficient predator that could be expected to prey on Gila chub, and have been reported on preying on a related species roundtail chub (Schwemm and Unmack 2001, P. Unmack pers. comm. 2009).

Habitat in the perennial reach that is Gila chub critical habitat is not ideal for these nonnative species, as it is mostly shallow riffles and runs with a sand substrate, and only a few pools about 0.5 m deep at maximum on June 28, 2001 when surveyed by Brian Bagley (Bagley 2002). But given the degree of connectivity between Gila chub habitat and Granite Basin Lake, largemouth

bass, an efficient fish predator, could persist for at least short periods of time in Gila chub habitat and prey on Gila chub.

Potential impacts to designated critical habitat must be considered based on the result of those impacts to the ability of the critical habitat unit to contribute to the recovery of the species. When last surveyed in 2001, Gila chub critical habitat in Williamson Valley Wash appeared to have all of the primary constituent elements and remained functional as evidenced by multiple year classes of Gila chub, although the presence of fathead minnow, mosquitofish, and bullfrogs would have diminished the value of critical habitat for recovery at the time of designation. The addition of a significant nonnative predator (largemouth bass), even if only for short periods of time, may further deteriorate Gila chub critical habitat. The likelihood of largemouth bass reaching the critical habitat is low (due to distance and flow conditions from Granite Basin Lake), which does ameliorate the risk of adverse effects occurring. While surveys are limited, neither stocked species has been documented and both have been stocked into Granite Basin Lake for many years and been present when the lake spills. Since no populations of largemouth bass or bluegill have established in the wash, the habitat may not be suitable for them, or, the number of individuals that reach the wash is so low and they do not persist there to form the nucleus of a population. Thus, the effects to PBF 6 from the limited numbers of largemouth bass or bluegill that may access the critical habitat unit is unlikely to preclude the presence of Gila chub in this critical habitat unit. Under those circumstances, while the individual predatory sportfish may be present at some time, the effect is not sufficient to significantly reduce the recovery value of this critical habitat unit.

However, because the critical habitat is on private land and we have no agreements with the landowner to allow for any post-spill monitoring, we are unable to survey the critical habitat and remove any largemouth bass or bluegill should they have moved into the critical habitat from the lake to minimize the time of exposure to the nonnative predator. Efforts to work with the landowners should be continued or initiated as part of the development of the recovery plan.

## CUMULATIVE EFFECTS

We assume that current activities on the private land in Williamson Valley Wash that supports Gila chub will continue to occur into the future. We are not aware of any efforts by the landowner to alter that management.

Live baitfish are illegal at Granite Basin Lake, however, tiger salamanders are legal and may be used to pursue largemouth bass. Tiger salamanders have not been documented in the watershed. Tiger salamanders are generalist predators and are known to eat small fish. Anglers have a tendency to release tiger salamanders into bodies of water once they are done fishing, which allows the potential for establishment of a population in Granite Basin Lake that could, during flood event, move downstream into occupied Gila chub habitat.

### *Middle Verde River*

## **Description of the Action Area**

Gila chub habitats that are tributary to Oak Creek and Wet Beaver Creek may be affected by the proposed action of stocking rainbow trout into those reaches. Barriers exist on Spring Creek and Walker Creek that may prevent access of nonnative species to the occupied habitats in those areas. Red Tank Draw does not have a barrier. Any Gila chub that leave those occupied habitats may encounter stocked rainbow trout in the creeks. The action area is defined as Oak Creek Bubbling Ponds and Page Spring hatcheries to its confluence with the Verde River, including Spring Creek through the critical habitat reach and Wet Beaver Creek from its confluence with Dry Beaver Creek upstream to the head of the stocking reach and including Red Tank Draw and Walker Creek to the upstream ends of the critical habitat reaches. Red Tank Draw is three miles below the stocking reach in Wet Beaver Creek, and Walker Creek is two miles below.

#### **A. Status of the species and critical habitat within the action area**

Gila chub are found in Spring Creek, a tributary to Oak Creek that has its confluence in the lower end of Oak Creek downstream from Bubbling Ponds and Page Springs hatcheries. This population is considered to be stable-threatened. Critical habitat is designated on 5.7 km (2.6 mi) from the Coconino National Forest boundary (approximately 0.50 miles above the confluence with Oak Creek) to the crossing of Highway 89A. This represents 18 percent of the critical habitat designated in the Verde River basin in four units. Fathead minnow and smallmouth bass are nonnative fishes reported from Spring Creek (Weedman et al. 1996). Fathead minnows continue to be documented; however, smallmouth bass have not been seen since 1979. Only fathead minnows were found in 2003. The critical habitat only includes three sections of Coconino National Forest lands that are interspersed with private lands. Land use along Spring Creek on the Federal and Arizona state lands includes livestock grazing and, on Forest Service lands, recreation. There is at least one diversion dam on the private lands, and land uses are unclear, but likely include some agriculture and residential development. Additional residential development on the private lands is likely to occur in the future.

Gila chub are found in Red Tank Draw, a southward flowing tributary to Wet Beaver Creek. This population is considered stable threatened. Critical habitat is 11.1 km (6.9 mi) from the National Park Service boundary of Montezuma Castle National Monument upstream to the confluence of Mullican and Rarick canyons. This represents 35 percent of the critical habitat designated in the Verde River drainage in four sites. Green sunfish and smallmouth bass are found in the occupied habitat. Surveys in 2007 near Forest Road 618 did not detect any Gila chub but documented large numbers of green sunfish and smallmouth bass (Rinker 2007). This location was occupied by Gila chub and green sunfish in 1995; and the presence of green sunfish may have eliminated the Gila chub. Surveys in 2005 (Knowles 2005) found Gila chub in an area at least three miles upstream of FR 618, with some green sunfish. The population may be experiencing declines as smallmouth bass and green sunfish invade further upstream. Most of the critical habitat reach is on the Coconino National Forest, with a minor amount of private land near its confluence with Wet Beaver Creek. Livestock grazing is one of the multiple uses of the adjoining watershed.

Walker Creek is a northwest flowing tributary to Wet Beaver Creek. This population is considered stable-threatened. Critical habitat is 7.6 km (4.7 mi) from the Forest Road 618 crossing upstream to its confluence with Spring Creek (not the Spring Creek in Oak Creek). This



represents 24 percent of the critical habitat designated in the Verde River drainage in four sites. No nonnative fish are present in the critical habitat reach. Most of the critical habitat is on Forest Service lands, with the lower portion of the reach on private lands. Livestock grazing and dispersed recreation are dominant uses of the watershed.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

Land management actions by the Forest Service, particularly livestock grazing and recreation, have effects to Gila chubs and their habitat. Use of private lands for residential or agricultural purposes can also affect chubs and their habitat. The presence of nonnative fish, amphibians (bullfrogs), and crayfish also have adverse effects to Gila chub through predation and competition. The three Gila chub populations in the middle Verde drainage are considered stable-threatened; however, recent surveys are limited and status in 2010 cannot be fully determined. Surveys in 2007 documented large numbers of smallmouth bass and green sunfish in Red Tank Draw and Gila chub are unable to persist with green sunfish. In 2007, Walker Creek had only native fish species. In 2003, Spring Creek was surveyed and fathead minnow was the only nonnative fish found.

#### **EFFECTS OF THE ACTION**

Gila chub may be exposed to stocked rainbow trout if they move into Oak Creek or Wet Beaver Creek during the time rainbow trout are likely to be present, or, in the case of Red Tank Draw, rainbow trout move up the draw into Gila chub habitat. Rainbow trout are not likely to access Spring Creek or Walker Creek critical habitat units due to the presence of barriers; although the efficacy of those barriers at high flows to prevent upstream movement of fish is unknown. Rainbow trout have not been found upstream of these barriers, and some surveys were accomplished during the time when conditions were favorable for rainbow trout survival, and they were being stocked into the system at that time. The transition to triploid rainbow trout as part of the proposed action will essentially eliminate the opportunity for stocked rainbow trout to contribute to the maintenance of any wild rainbow trout population in the Verde River tributaries.

As described in the interactions document in Appendix D, stocked rainbow trout do not persist long in the stream after the stocking event due to a number of factors including natural mortality events, angler catch, and predation by other species (such as brown trout or smallmouth bass) on the stocked trout. The repeated stockings are necessary to maintain a fishable population under these conditions. Stocked rainbow trout can and do convert to eating natural foods if they live long enough to do so, and can be predators on small fish at that time. The number of times that potential predation event can be realized is difficult to determine since for the event to occur, the individual stocked rainbow trout must survive long enough to convert to natural feeding and access the occupied habitat of the native fish. Over a 10-year period, this may occur, but we do not expect it to be a common occurrence as described below.

Oak Creek is stocked with 60,000 rainbow trout from March to November, and the lowest stocking site at Cornville is below the confluence of Spring Creek. There are 28 stocking sites along Oak Creek, and the distribution of rainbow trout among these sites is likely variable based

on fishing pressure, water temperature, and other concerns. Water temperatures during the summer likely preclude much rainbow trout survival in these lower elevations; however, rainbow trout can exist in the spring and fall. Spring is likely to be the period when exposure of Gila chub to rainbow trout is most likely, as spring runoff flows may carry Gila chub into Oak Creek, or allow rainbow trout to move up into Spring Creek. Surveys have not documented either species in the other's occupied areas; however, the survey record is not robust for the area near the confluence or in Spring Creek itself. Oak Creek at the Spring Creek confluence has a robust population of nonnative fish, including green sunfish, which prevent any Gila chub population from establishing in Oak Creek.

Rainbow trout moving into the critical habitat at Spring Creek could have effects to PBF number 6, dealing with the presence of nonnative species at levels that allow Gila chub to survive and reproduce. The number of rainbow trout likely to access Gila chub habitat is probably very low, based on the number of rainbow trout likely to be present and the limited time period that flows may be high enough to compromise the barrier during spring runoff. Gila chub spawn between 20 and 26° C, and rainbow trout can survive in temperatures up to 25° C although they avoid temperatures above 18° C. There is then an opportunity for rainbow trout that access Spring Creek to prey on larval Gila chub, although it is very limited due to temperature constraints on survival of rainbow trout in Oak Creek to reach Spring Creek during the Gila chub spawning season. Any rainbow trout that did reach the critical habitat area would not persist there due to high temperatures (there is no wild rainbow trout population there now which supports this information). The limited opportunity for stocked rainbow trout to access the critical habitat reach and the limited amount of time there could be exposure to young Gila chub does not support a conclusion that the recovery value of the Spring Creek critical habitat unit would be compromised. It should also be noted that establishment of rainbow trout in the critical habitat reach would not be supported by the stocking of triploid rainbow trout.

In Wet Beaver Creek, a total of 6,000 rainbow trout are stocked from March-May and October-November. Rainbow trout can move downstream from the stocking reach to the confluences with Red Tank Draw and Walker Creek. Rainbow trout can move up Red Tank Draw, but not Walker Creek, as there is a barrier on the Forest Service land upstream of the private land at the bottom of the critical habitat reach. The barrier is a diversion dam that when in operation, diverts nearly all the water from the creek and dries up the creek below, including a portion of designated critical habitat. The dry creekbed prevents rainbow trout from moving upstream, and the lack of any nonnative fish in Walker Creek indicates that the barrier is effective at all flows, as there are nonnative species in Wet Beaver Creek. We do not anticipate any effects to PBF 6 in Walker Creek from the proposed action. Gila chub in Walker Creek can move out of the occupied habitat during spring runoff and access Wet Beaver Creek during the time when rainbow trout may be present. Due to the presence of green sunfish in Wet Beaver Creek, establishment of Gila chub populations in the creek is unlikely. Rainbow trout are an additional predator on larval Gila chub that may be produced in Wet Beaver Creek; however, their temporary presence does not alter potential for establishment of Gila chub in the creek itself.

Red Tank Draw does not have a barrier to prevent rainbow trout from accessing the stream, including the critical habitat, however, the stream is intermittent and fully connected with Wet Beaver Creek only during high flow events. Rainbow trout have never been found in Red Tank

Draw. The distance upstream to what may be occupied Gila chub habitat is over four miles, and stocked rainbow trout are unlikely to survive long enough to be able to move upstream that far due to factors discussed above and the intermittent nature of the stream. Rainbow trout do not persist in Wet Beaver Creek during the summer due to high temperatures (which is why the creek is not stocked in June-September), so there is no wild population that may be supported by the stocked rainbow trout (which will not occur under the proposed action since all rainbow trout stocked will be triploid once the conversion is completed in three years). As with Walker Creek, Gila chub can be displaced downstream to Wet Beaver Creek where they would be unable to establish a population due to nonnative warmwater predators with stocked rainbow trout adding only a limited additional impact.

Rainbow trout moving into the critical habitat at Red Tank Draw could have effects to PBF number 6, dealing with the presence of nonnative species at levels that allow Gila chub to survive and reproduce. The portion of the critical habitat unit they are most likely to reach is the lowest area and this contains populations of green sunfish and smallmouth bass in numbers that preclude survival and recruitment of Gila chub in this portion of the critical habitat. The additional effect of rainbow trout in this reach is unlikely to alter the nonnative fish community such that it would further degrade the existing conditions for PBF 6. The limited opportunity for stocked rainbow trout to access the critical habitat reach above the portion containing nonnative fish species and the limited amount of time there could be exposure to young Gila chub does not support a conclusion that the recovery value of the Red Tank Draw critical habitat unit would be compromised.

## CUMULATIVE EFFECTS

The stocking sites are mostly on the Coconino National Forest, and land management activities are subject to section 7 consultation. We are unaware of any new activities proposed for non-Federal lands within the action area that could result in additional adverse effects to Gila chub or its critical habitat.

Use of live bait is illegal in Oak Creek and Wet Beaver Creek. Use of tiger salamanders to pursue stocked rainbow trout is unlikely; however, they may be used for other warmwater species in the drainage. Tiger salamanders are generally not resident in streams, so the potential for exposure to Gila chub is limited.

### *Santa Cruz River*

#### **Description of the action area**

Rose Canyon Lake is proposed for stocking with rainbow trout and brown trout, and is hydrologically connected to Bear Canyon and Sabino Creek (tributaries of the Rillito River which is tributary to the Santa Cruz River), occupied habitat for Gila chub. The action area for this drainage is from Rose Canyon Lake downstream to occupied Gila chub habitat in Sabino Creek, including Bear Canyon.

#### **A. Status of the species and critical habitat within the action area**

Gila chub are present in Sabino Canyon in a stable-secure population as a result of removal of nonnative fish, with no nonnatives documented since 1999. The stocked population in Bear Canyon may be extirpated; however, the one in Romero Canyon appears to be maintaining a stable-threatened population (Ehret and Dickens 2009). Critical habitat in Sabino Creek extends 11.1 km (6.9 mi) from the southern boundary of the Coronado National Forest upstream to the confluence with the West Fork of Sabino Canyon. This represents 15 percent of the 44.1 km (29.8 mi) designated as critical habitat in the Lower Santa Cruz's four streams included in the designation.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

Habitats in Sabino Creek were affected by the Aspen Fire in 2003 when ash and debris scoured through the canyon after the fire and deposited sediments in pool habitats, altered water quality, and reduced the invertebrate food base, all PBFs of critical habitat. These same PBFs were again damaged by flooding in July 2006 which triggered debris flows that also damaged infrastructure along the creek. Efforts to repair damaged infrastructure had some effects to Gila chub habitat, but these were minimized by conservation measures included in the proposed action for the repairs and there were no long-term adverse effects. Gila chub were salvaged from Sabino Creek prior to the ash flows from the Aspen Fire, and were repatriated in 2005. They survived the 2006 event, and habitats have recovered somewhat, such that the 2009 population estimate for Gila chub has increased and they are found throughout the critical habitat reach above Sabino Lake. Wild rainbow and possibly brown trout may be in the upper reaches of Sabino Creek, but have not been documented in Gila chub habitat; although most surveys are done in the summer when trout would be unlikely to be found due to high temperatures. Flooding has also eliminated mosquitofish from the critical habitat, and active removal efforts eliminated green sunfish. Crayfish have not been detected since 2006.

Sabino Canyon Recreation Area is on the Coronado National Forest and includes the occupied habitat and critical habitat for Gila chub. This is a heavily used day-use only recreational area with a paved road, picnic areas with restrooms, and hiking trails. Swimming and wading in the creek is allowed. Past recreational use may have contributed to the presence of nonnative species in Sabino Creek; current rules and regulations posted for visitors' state that such introductions are illegal. Use of the creek may displace Gila chub, contribute to sedimentation from walking on the banks or trails that causes erosion, and water quality issues, particularly during low flow periods.

Bear Canyon is also used by recreationists, with a campground at the lower end and hiking trails along the stream to within a mile or so of Sycamore Spring Lake (an old, silted in reservoir), and another hiking trail crossing the creek just below the dam. Bear Canyon was affected by the Aspen Fire due to increased sediment inflows from tributaries in the burned area, and sediment moving out from the lake bed that can fill in downstream pool habitats. These pools are formed by erosion in the bedrock, forming what are called tinajas, which are vulnerable to filling in by sediments. Gila chub stocked into the creek were put below Sycamore Spring Lake, and occupied habitat exists (assuming the species still does) downstream. No nonnative fish are found in the creek.

The aggregate effects of post nonnative species introductions, catastrophic wildfires upstream in the watersheds, and recreational activities are responsible for the unstable-threatened status of Gila chub in the action area. However, this status is improving due to active management of Gila chub in the action area by the Coronado National Forest, AGFD, and USFWS.

## EFFECTS OF THE ACTION

Gila chub may be affected by stocking of rainbow trout and brown trout in Rose Canyon Lake if individuals of those species are transported out of the lake when it spills. However, the survivorship of trout exiting the lake is likely very low since there is a 60 foot drop to the stream below and few trout would be expected to survive the fall. Water from the lake enters Bear Canyon above Sycamore Spring Lake, and moves downstream to the confluence with Sabino Canyon, going over seven waterfalls during the trip. From the confluence with Sabino Creek, trout can move upstream to the base of Sabino Dam but not access critical habitat above the dam. There is approximately one km (0.5 mi) of critical habitat below the dam to the Forest Service boundary that may be accessed by trout. This represents nine percent of the Sabino Canyon critical habitat unit. Any trout that reached this area could not persist into the summer due to high water temperatures, but can be present during the winter. Any Gila chub displaced below Sabino Dam are lost to the population above the dam, but can persist in Sabino Creek, which is perennial at least within the critical habitat area. The status of any Gila chub below Sabino Dam is uncertain; however, they may be present in a recruiting population. Crayfish are present in this reach, but not at densities that preclude Gila chub recruitment. Any rainbow or brown trout that reach this area during the snowmelt period may be present for the early breeding period of Gila chub, and these trout are likely to be attuned to foraging on natural foods, since they would have been at large for at least several months in the lake. Should any trout survive, there is potential for predation on small Gila chub and competition for space in pool habitats.

Similarly, any trout that remain in Bear Canyon post-spill would be in the same pool habitats as Gila chub, since those are the only perennial habitats available. The trout could not persist long-term due to temperatures, but while they are present, there is opportunity for predation and competition.

The effects to designated critical habitat relate to PBF 6, the presence of nonnative species in Gila chub habitat that affects their survival and recruitment. Over the 10-year period, we anticipate that very few trout would be washed out of Rose Canyon Lake and survive to enter the 1 km (0.5 mi) portion of the critical habitat reach on Sabino Creek that is below the barrier. Due to high summer temperatures, their presence in the habitat would be short, and, the effect of predation on young Gila chub is ameliorated by the limited time of exposure possible. Further, this exposed portion of the critical habitat is only nine percent of the total for the unit, and the remaining 91 percent remains unaffected by the proposed action. The rare event of trout presence in the lowest 1 km (0.5 mi) of critical habitat not expected to be sufficient to affect recruitment to the Sabino Canyon population as a whole or in the affected part of the unit. The recovery value of this unit for Gila chub is not compromised by the proposed action.. The temperature conditions within the critical habitat preclude the establishment of any trout population in the unit.

## CUMULATIVE EFFECTS

The Sabino Creek action area is largely on the Coronado National Forest, and land management activities are subject to section 7 consultations. The small area of private land at the Sabino-Bear Canyon confluence and upstream to the forest boundary is an urban area with residences, schools and commercial interests present. We are not aware of any significant new development on the private lands that would alter conditions in the critical habitat.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to Gila chub populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect Gila chub. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

Cross-border violation (CBV) activity in southern Arizona has resulted in route proliferation, off-highway vehicle activity, increased human presence in backcountry areas, discarded trash, abandoned vehicles, cutting of firewood, illegal campfires, and increased chance of wildfire. Additionally, contamination of water sources, including stock tanks used for bathing or waste disposal is of concern for the Gila chub.

## CONCLUSION

After reviewing the current status of Gila chub and its critical habitat, the environmental baseline for the action areas, the effects of the proposed sportfish stocking and the cumulative effects, it is the FWS's biological opinion that the sportfish stocking actions, as proposed, is not likely to jeopardize the continued existence of the Gila chub, and are not likely to destroy or adversely modify designated critical habitat for Gila chub.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

We present this conclusion on Gila chub for the following reasons:

- In all cases, stocked sportfish would have to leave the stocking area to access occupied habitats of the Gila chub. We do not anticipate that the number of such fish accessing occupied habitat over the 10-year period covered by this consultation will represent a significant effect to the status of the Gila chub populations through predation or competition. The movement of stocked sportfish to occupied Gila chub habitats in the Agua Fria drainage is likely to be a very rare event, and effects to Gila chub in the vulnerable Silver Creek population would be additive to that from existing nonnative species present. Rainbow trout in Oak Creek and Wet Beaver Creek are more likely to reach occupied habitats in Spring Creek and Red Tank Draw; however, this is likely also a rare event and they would not persist in these areas due to high temperatures, so their effect on young Gila chub would be of limited duration and not sufficient to affect recruitment, particularly since such events are unlikely to occur every year. Trout from Rose Canyon Lake would also be very rare in Gila chub habitat in Bear Canyon and Sabino Canyon, and the sites accessed are not where the main body of the population exists in Sabino Creek, which would not be affected.
- Spills from Granite Basin Lake may introduce largemouth bass to the limited habitat present in Williamson Valley Wash. Largemouth bass have not been documented at the site, and the likelihood of largemouth bass reaching the site is low. If largemouth bass were to reach the occupied habitat, there could be significant adverse effects to Gila chub. However, this potential for loss of this population due to the proposed action is limited due to the exposure potential as described.
- Gila chub may be exposed to stocked sportfish if they move out of occupied habitats into areas where the sportfish may be found. This is most likely to occur in Oak Creek and Wet Beaver Creek, where the stocking site is proximal to the occupied habitats. The effects of trout on Gila chub are limited in duration, and, while trout are predators on fish, the additive contribution of this predation over that which occurs in these streams due to warmwater fish, frog, and crayfish predation is not sufficient to alter the recruitment potential for Gila chub in these streams. Gila chub that move out of the Agua Fria tributary habitats are at risk of exposure during the limited time stocked sportfish may be

present; however, the additive predation on young Gila chub is not sufficient to alter the recruitment potential in the Agua Fria River.

- The limited potential for short-term presence of stocked rainbow trout in Gila chub critical habitats at Red Tank Draw, Sabino Creek, and Spring Creek is unlikely to significantly alter conditions under PBF 6 such that the critical habitat could no longer function to support recovery to the species. The invasion events are likely to be few, with few fish involved, and would be of short duration due to summer temperatures that would eliminate the trout. Rainbow trout would not establish populations in these critical habitat units, so additional significant effects to the existing condition of PBF 6 would not occur, thus not compromising the ability of these critical habitat units to support recovery of the species. The potential invasion of the Williamson Valley Wash critical habitat unit by largemouth bass may alter conditions there under PBF 6 sufficiently to reduce or eliminate its conservation value. However, as discussed, the likelihood of an flood event that allows for the establishment of a largemouth bass population in the critical habitat unit is low and we do not believe this potential threatens the recovery value of this unit for Gila chub for reasons stated earlier. However, unlike other critical habitat units, we are currently unable to monitor for nonnative fish in this unit, and without that ability we would be unable to address the presence of largemouth bass. Because this unit only accounts for three percent of the total critical habitat (and 22 percent of that in the Agua Fria River drainage, and we believe any incursion of largemouth bass is likely to be rare and not result in the creation of an established population, we believe that at the present time, sportfish stocking in Granite Basin Lake will not significantly reduce the recovery value of this unit of critical habitat due to the limited opportunity for nonnative species to reach this critical habitat unit.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.



Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by WSFR so that they become binding conditions of any grant or permit issued to AGFD, as appropriate, for the exemption in section 7(o)(2) to apply. WSFR has a continuing duty to regulate the activity covered by this incidental take statement. If WSFR (1) fails to assume and implement the terms and conditions or (2) fails to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WSFR or AGFD must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Fain, Lynx, Granite Basin, and Rose Canyon lakes: Gila chub are not present in these stocking sites, and for exposure to occur, stocked sportfish must leave the stocking site to reach Gila chub habitat. Based on physical conditions and distance between the stocking sites and Gila chub habitat, the opportunity for exposure to stocked sportfish is low. We cannot be reasonably certain that incidental take from the proposed action will occur, thus cannot meet the second condition.
- Wet Beaver Creek: Gila chub are found upstream of the stocking site, and it is likely that individuals are found downstream in the stocking site, thus meeting the first condition. The stocked rainbow trout are less likely to be active predators on Gila chub than the smallmouth bass present in the stocking site. We are unable to be reasonably certain that any predation on Gila chub would be the result of the proposed action, thus cannot meet the second condition.

The AESO anticipates an unknown number of Gila chub will be taken as a result of the stocking of rainbow trout into Oak Creek. The incidental take is expected to be in the form of harassment (competition for food and space) between Gila chub and rainbow trout and harm (predation) from rainbow trout preying on small Gila chub. The take will occur in the occupied habitat of Gila chub above the barrier on Spring Creek during times when stocked rainbow trout move upstream of the barrier.

The amount of the incidental take can be anticipated by the surrogate measure of number of

stocked rainbow trout present in the occupied habitat during the Gila chub. Stocked trout can usually be distinguished from wild trout by experienced observers, so identification of any trout captured can be accomplished in the field. Based on past survey data from the occupied habitat of Gila chub in Spring Creek that has documented few nonnative species (and no rainbow trout) present, we consider the presence of stocked rainbow trout to be a rare event in occupied Gila chub habitat, so we anticipate that take of Gila chub would not occur every year. The amount of incidental take will be exceeded if any stocked rainbow trout are found in occupied Gila chub habitat above the barrier in Spring Creek in any two survey efforts as described in the terms and conditions.

#### EFFECT OF THE TAKE

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

#### REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS (as appropriate)

The following reasonable and prudent measures are necessary and appropriate to minimize take of Gila chub:

1. AGFD shall monitor Spring Creek to determine if stocked rainbow trout are present above the barrier.
2. AGFD shall monitor incidental take resulting from the proposed action and report to the FWS the findings of that monitoring.

#### TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, WSFR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Implementation of these terms and conditions is part of the CAMP.

The following term and condition implements reasonable and prudent measure #1 for Gila chub:

1. AGFD shall survey the occupied Gila chub habitat on public lands in Spring Creek above the barrier when habitat conditions are conducive to rainbow trout persistence in two years during the 10-year period. If any stocked rainbow trout are found, these will be documented and removed from the stream and an additional survey to locate stocked rainbow trout will be implemented in the following year.

The following term and condition implements reasonable and prudent measure #2 for Gila chub:

1. In years when incidental take monitoring occurs, AGFD shall submit to WSFR a report of that monitoring either with the annual report on implementation of the CAMP, or, if there is no CAMP report scheduled for that year, by the due date normally set for the delivery of the CAMP report. WSFR will submit the incidental take monitoring report to AESO within the timeline set for reporting on implementation of the CAMP.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. WSFR, using information provided by AGFD, must immediately provide an explanation of the causes of the taking and review with the AESO the need for possible modification of the reasonable and prudent measures.

### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. As identified in the CAMP, AGFD will work with AESO and partners to develop and implement a recovery plan for the Gila chub. As part of that effort, conservation needs for the species relative to nonnative fish species will be identified and included in the plan.
2. We recommend that AGFD continue efforts to work with the landowners at Williamson Valley Wash and Spring Creek to obtain access for surveys and management actions for the Gila chub populations there.
3. We recommend that AGFD continue monitoring of the Red Tank Draw Gila chub population, and evaluate the potential for a barrier to exclude nonnative fishes from the stream.
4. We recommend that AGFD continue to work with BLM and FWS to eliminate nonnative species from the Las Cienegas NCA and drainages that feed into it.

5. We recommend that AGFD continue to work with the Forest Service and FWS to conserve other populations of Gila chub in Arizona.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### **Gila topminnow (*Poeciliopsis occidentalis occidentalis*)**

#### **DESCRIPTION OF THE PROPOSED ACTION**

Natural populations and reintroduced populations of Gila topminnow may be affected by stocking actions in the Agua Fria River, the lower Salt River, Middle and Lower Verde River and Santa Cruz River (Table 5). No stocking sites are directly into Gila topminnow habitats, for effects to occur, stocked fish must either move into Gila topminnow habitats or the Gila topminnow move out of their habitats into the stocking reach. New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 5: Stocking sites, sportfish species proposed for stocking, and potentially affected Gila topminnow populations. An (R) indicates a re-established population.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking</b>           | <b>Species population affected</b>                                                     |
|------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------|
| <i>Agua Fria</i>             |                                                |                                                                                        |
| Fain Lake                    | ONMY, SAFO, SATR, ONCL, LEMA, MISA, POAN, ICPU | Lousy Canyon (R)<br>Larry Canyon (R)<br>Tule Creek(R)                                  |
| Lynx Lake                    | ONMY, SAFO, SATR, ONCL, LEMA, MISA, POAN, ICPU | Lousy Canyon (R)<br>Larry Canyon (R)<br>Tule Creek (R)                                 |
| <i>Lower Salt River</i>      |                                                |                                                                                        |
| Canyon Lake                  | ONMY, SAVI, MIDO, MISA, PONI                   | Unnamed #68 (R)<br>Charlebois Spring (R)                                               |
| Saguaro Lake                 | ONMY, SAVI, MIDO, MISA, PONI                   | Hidden Water Spring (R)                                                                |
| <i>Verde River</i>           |                                                |                                                                                        |
| Middle Verde River           | OMNY                                           | Fossil Creek (R)                                                                       |
| East Verde River             | ONMY                                           | Fossil Creek (R)                                                                       |
| Green Valley Lake            | ONMY                                           | Fossil Creek (R)                                                                       |
| <i>Santa Cruz River</i>      |                                                |                                                                                        |
| Parker Canyon Lake           | ONMY, ICPU, LEMA, LEMI                         | San Rafael Valley                                                                      |
| Patagonia Lake               | ONMY                                           | Sonoita Creek<br>Cottonwood Spring<br>Monkey Spring<br>Redrock Canyon<br>Fresno Canyon |

|                  |      |                  |
|------------------|------|------------------|
|                  |      | Coal Mine Canyon |
| Peña Blanca Lake | ONMY | Santa Cruz River |

#### Conservation measures included in the proposed action

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild or reintroduced populations of Gila topminnow.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

#### STATUS OF THE SPECIES (rangewide and/or recovery unit)

##### *Listing*

Gila topminnow was listed as endangered in 1967 without critical habitat (32 FR 4001). Only Gila topminnow populations in the United States, and not in Mexico, are listed under the ESA.

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Gila topminnow. This information was taken from the 1984 recovery plan (USFWS 1984), the draft revised Gila topminnow recovery plan (Weedman 1998), and references cited in the plans. For additional information about the Gila topminnow see Desert Fishes Team (2003), Minckley (1999), Hedrick et al. (2001), and (Voeltz and Bettaso 2003). Information in these documents is incorporated by reference.

## Life history

Gila topminnow is a live-bearing minnow species with females reaching two inches and males one inch. Breeding is primarily from March to August; however pregnant females may be found at any time of year in habitats supported by warm springs. Brood time is 24-28 days, and young Gila topminnow may take a few weeks to a few months to mature. Gila topminnow is short-lived, with an average life span of less than a year.

Gila topminnow is an opportunistic feeder on bottom debris, vegetation, amphipods, and insect larvae.

## Habitat use

Gila topminnow use shallow shorelines and slackwater areas of small streams, springs, and marshes. They concentrate in protected inlets, shoreward of sandbars or debris, or associated with aquatic or streamside vegetation. They are tolerant of a wide range of temperature and water chemistry.

## Current distribution

As of 2008, Gila topminnow existed in nine of the 16 recent natural populations and in 21 reintroduced localities (USFWS 2008a). Two of the natural populations are contaminated by nonnative fish species. Voeltz and Bettaso (2003) reported that three of 18 extant reintroduced populations (as of 2003) were contaminated by nonnative fish species. Additional reintroductions by the Gila River Basin Native Fishes Conservation Program of Gila topminnow were made since 2008 (Robinson 2010).

## Threats

The reasons for decline of this fish include past dewatering of rivers, springs and marshlands, impoundment, channelization, diversion, regulation of flow, land management practices that promote erosion and arroyo formation, and the introduction of predacious and competing nonindigenous fishes (Miller 1961, Minckley 1985). Other listed fish suffer from the same impacts (Moyle and Williams 1990).

## Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the Gila topminnow recovery plan. Conservation measures under the Gila River Basin Native Fishes Conservation Program are underway in the range of the species and include creation of reestablishment areas through barrier construction and chemical renovation to remove nonnative species. Gila topminnow is also a covered species in the Horseshoe-Bartlett Habitat Conservation Plan (SRP 2008) for the Verde River. In addition, the Safe Harbor Agreement for Gila topminnow and desert pupfish allows private individuals in Arizona to establish populations of this species for conservation purposes.

*Previous consultations*

Section 7 consultations on Gila topminnow include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Gila topminnow may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

**ENVIRONMENTAL BASELINE [in the action area]**

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

**Description of the Action Area**

The stocking sites and affected Gila topminnow populations are located in disjunct locations of several watersheds. There are both natural and reintroduced populations potentially affected by the proposed action. Instead of defining several action areas, we define one for the natural populations in the Santa Cruz River Basin, and one collective assessment for reintroduced populations in the Agua Fria, lower Salt River, and Middle/Lower Verde River.

Reintroduction sites**A. Status of the species and critical habitat within the action area**

Gila topminnows were stocked into the reintroduction sites listed in Table 5 as conservation actions to move toward recovery of the species. Except for Fossil Creek, all the listed reintroduction sites maintain self-sustaining populations as of the last time they were evaluated. All reintroduction sites currently have a natural or man-made barrier at the lower end of the stream reach that prevents the upstream movement of nonnative fish.

**B. Factors affecting species environment and critical habitat within the action area**

None of the reintroduction sites in Table 5 is contaminated by nonnative fish species (Voeltz and Bettaso 2003, Robinson 2010). All sites are on Federal lands (Forest Service or Bureau of Land Management) and watersheds are managed for multiple uses under the relevant land management plan or resource management plan. Flooding may affect these populations by altering the stream conditions and displacing individuals. Drought is also a concern, since most of these sites are small areas in the headwaters of small streams.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the Gila topminnow are in the Gila topminnow the recovery plan (USFWS 1984) the draft revised recovery plan (Weedman 1998), background documents for the Central Arizona Project consultations (USFWS 2001, 2002), and the Safe Harbor biological opinion (USFWS 2008c). The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish on Gila topminnow.

The effects of the proposed action of stocking sportfish into the stocking sites hydrologically connected to upstream reintroduction sites is primarily predation on any Gila topminnow that leaves the reintroduction site due to natural flow events that cause it to reach the stocking site. Some of the stocked sportfish species, particularly black crappie, channel catfish, largemouth bass, and smallmouth bass are more likely to be predators on small fish than the other stocked species. However, there is potential for predation on Gila topminnow from any of the stocked species. Competition for food and space may also occur in shallow water habitats where Gila topminnow would be located that also provides these resources to the stocked sportfish.

The number of times and the specific locations where Gila topminnow may be exposed to stocked sportfish species is uncertain. Gila topminnow are adapted to normal hydrological cycles in desert streams, however, they may still be displaced downstream if suitable low-velocity refuge sites are not available. In some cases, particularly on the Agua Fria River and Middle/Lower Verde River, the stocked fish species must be transported by high flows or move themselves through connected waterways to be present at the inflow area from the reintroduction site; thus, both Gila topminnow and stocked sportfish species must move or be moved for co-occurrence to take place at some sites. The specific analysis for these sites is described below.

### *Agua Fria River*

Stocked sportfish from Fain and Lynx Lake may be transported downstream in the Agua Fria River toward the confluences with Larry Creek, Lousy Canyon and Tule Creek. Lynx Lake spilled during the spring runoff in 1999, 2005, 2007, and 2009. High flows were documented at downstream USGS gages during the spring in 2005 and 2009. The distance from the confluence of Lynx Creek and the Agua Fria River to the confluences with Larry Creek and Lousy Canyon is well over 30 miles, and it is an additional 15 or more miles to the confluence with Tule Creek



at the uppermost end of Lake Pleasant. Flood flows from the headwaters of the Agua Fria River may also correspond with high flows in one or more of the reintroduction sites that could displace Gila topminnow.

Gila topminnow stocked into Larry Creek and Lousy Canyon were considered likely to disperse downstream to the confluence with the Agua Fria River (USFWS 1998). The presence of nonnative species (mosquitofish and green sunfish) at the confluence was noted in the biological opinion for the reintroduction, and the Agua Fria River was considered not to be suitable habitat for Gila topminnow, and any Gila topminnow that reached there would be lost to nonnative fishes or other physical conditions in the river.

The 1998 biological opinion for Larry Creek and Lousy Canyon (USFWS 1998) (there is no such consultation for Tule Creek) did not discuss the potential for stocked sportfish to be in the Agua Fria River at the confluences. At the time of the 1998 biological opinion, Lynx Lake was already stocked with all the sportfish species included in the proposed action except largemouth bass and white crappie, and largemouth bass were already present likely due to an illegal stocking action. At the same time, Fain Lake was already being stocked with rainbow trout and channel catfish. Since Lynx Lake drains into Fain Lake, stocked species from Lynx Lake can access Fain Lake. Largemouth bass and bluegill are two species that had not been stocked into Fain that may have come from Lynx prior to 1999. Aside from mosquitofish and green sunfish, no other nonnative fish species were specifically mentioned in the 1998 biological opinion; however, other species were known to be present in the Agua Fria River at the time. In addition, the presence of stocked warmwater species, including white crappie, in Lake Pleasant was also known and likely was a contributing factor to the mainstem Agua Fria River not deemed suitable habitat for Gila topminnow in 1998.

In summary, while there is a potential for Gila topminnow to be exposed to stocked sportfish, that potential is low and the individuals are presumed to be lost to resident nonnative fish once they access the Agua Fria River. The loss of these individuals does not compromise the overall health and survival of the reintroduction populations.

#### *Canyon and Saguaro Lake*

Gila topminnow from the two sites on Canyon Lake and the one site on Saguaro Lake may enter the lakes during runoff periods. Because of the natural barriers, once Gila topminnows leave the reintroduction sites they are unable to return. There is no biological opinion covering these sites, and it is unlikely that the determination to put Gila topminnow into these isolated locations considered the presence of predators in the downstream lakes. However, the focus was on developing areas where Gila topminnow could live without nonnative predators reaching them, and considerations of effects to Gila topminnow that left the safe areas was less of a concern. Only one species not already stocked into the lakes at the time of the establishment of these reintroductions is proposed for stocking; that is the smallmouth bass. Smallmouth bass were present in the lakes before the 1980s (Minckley 1973) but were not officially stocked until 2007. The downstream dispersal of Gila topminnow into Canyon or Saguaro lakes has never been documented to occur; however, the small size of the Gila topminnow makes finding any individuals unlikely. The episodic nature of high flows reduces the opportunity for their transport

down to the lake and exposure to stocked sportfish.

In summary, there is a reasonable potential for Gila topminnow to be exposed to stocked sportfish and the individuals are presumed to be lost to stocked sportfish or other resident nonnative species once they reach Canyon or Saguaro Lake. The loss of these individuals does not compromise the overall health and survival of the reintroduction populations.

#### *Middle/Lower Verde River*

Gila topminnow from Fossil Creek may enter the Verde River during runoff periods. The barrier on Fossil Creek was funded by the Gila River Basin Native Fishes Conservation Program, and a barrier on Lime Creek will be funded by Salt River Project under their Horseshoe and Bartlett Reservoirs HCP. Once Gila topminnows leave the sites, they are unable to return due to the barriers. Lime Creek is a small tributary that enters the Verde River in Horseshoe Reservoir well downstream of any stocking site. Fossil Creek enters the Verde River between the West Clear Creek and East Clear Creek. The nearest stocking site to Fossil Creek is West Clear Creek, over 20 miles upstream. The Middle Verde and Green Valley Lake sites are within 30 miles. The species of concern are rainbow trout from all sites. Rainbow trout were stocked into the Middle/Lower Verde River sites prior to Gila topminnow stockings into Fossil Creek.

Rainbow trout from West Clear Creek, Middle Verde River, Oak Creek and Wet Beaver Creek have a permanent water connection to the confluence with Fossil Creek. The East Verde River is not perennial from the stocking site in the upper reaches to the confluence with the Verde River, but it is periodically connected. Few rainbow trout from these stockings are likely to be at the confluence with Fossil Creek due to distance and seasonal water temperatures that will not support rainbow trout year round (there are no permanent populations of rainbow trout in this reach of the Verde River). Rainbow trout from Green Valley Lake can reach the Fossil Creek confluence when that lake spills and move down the East Verde River with the high flows. In the Verde River they will not persist due to high temperatures in the summer.

In summary, there is some potential for Gila topminnow from the Fossil Creek conservation site to be exposed to stocked rainbow trout during the winter-spring period if topminnows move out of Fossil Creek and stocked trout have moved to the confluence of the Verde River with Fossil Creek. These individuals are considered lost to resident nonnative species once they reach the Verde River. The loss of these topminnows does not compromise the overall health and survival of the reintroduced population.

#### Natural Populations

Three stocking sites, Parker Canyon Lake, Patagonia Lake, and Peña Blanca Lake are in the vicinity of natural Gila topminnow populations.

#### **A. Status of the species and critical habitat within the action area**

The Santa Cruz River basin contains most of the remaining natural populations of Gila topminnow. The Sonoita Creek subbasin maintains populations in the mainstem of the creek

above and below Patagonia Lake and in several tributaries (Coal Mine Canyon, Cottonwood Spring, Fresno Canyon, Monkey Spring, and Sonoita Creek). In the San Rafael Valley, Gila topminnows are found in springs and the Santa Cruz River near Lochiel. Gila topminnows are also in the mainstem Santa Cruz downstream of Nogales near Tumacacori. As of 2008, these populations were extant; with two populations having nonnative species present (San Rafael and Sonoita Creek) (USFWS 2008a). The 2008 biological opinion for the Central Arizona Project provides information on the status of the species in the Santa Cruz drainage (USFWS 2008a).

## **B. Factors affecting the species' environment and critical habitat within the action area**

The draft recovery plan (Weedman 1999) identifies threats to the Gila topminnow populations in the action area from habitat destruction through groundwater pumping, improper land management that leads to channel incision and draining of cienegas, and the spread of nonnative aquatic species, particularly mosquitofish, but also potential predators such as largemouth bass. Ongoing drought is also a concern, as most Gila topminnow habitats in the action area are in small springs and streams. Conservation measures under the Gila River Basin Native Fishes Conservation Program are underway in the action area. In addition, the Safe Harbor Agreement for Gila topminnow and desert pupfish allows private individuals in the action area to establish populations of this species for conservation purposes.

### **EFFECTS OF THE ACTION**

#### *Parker Canyon Lake*

Annual stocking of 45,000 rainbow trout from October to April would result in this species persisting in the lake through the year but no recruitment to create a self-sustaining population is expected. Bluegill, redear sunfish, and channel catfish would only be stocked to augment the fishery or after catastrophic events had significantly reduced the extant self-sustaining populations. Parker Canyon Lake does spill, with flood flows reaching the Santa Cruz River in Mexico. Under normal circumstances, there is perennial water below the dam due to spring inputs, and except for another short perennial reach, the rest of the drainage is ephemeral and does not support fish. At the confluence with the Santa Cruz River, there is a channel through the agricultural fields to convey flood waters downstream. The perennial area below the dam does maintain warmwater nonnative fish, including largemouth bass (not proposed for stocking), and bluegill (which is proposed for stocking). No channel catfish have ever been found in the perennial reach.

The nearest populations of Gila topminnow are 18 miles up the Santa Cruz River in the San Rafael Valley. Gila topminnow have not been found near the confluence area with the Parker Canyon drainage, and individuals of the stocked sportfish species have not been found in Gila topminnow habitats in the San Rafael Valley. The potential for exposure of Gila topminnow to stocked sportfish or their progeny from Parker Canyon Lake is very low and effects to the topminnow populations in the San Rafael Valley are unlikely to occur.

#### *Patagonia Lake*

Annual stocking of 30,000 rainbow trout from November to March would result in this species persisting in the lake during the winter, but not through the summer when temperatures are too warm for rainbow trout to persist. While present in the lake, rainbow trout can move upstream when inflows are present, and below when water spills or is released to maintain water rights from Patagonia Lake. Perennial flows are present above and below the lake during the time rainbow trout would be present. AGFD survey data have not documented rainbow trout downstream of the lake, but one was found in Sonoita Creek upstream of the lake. Gila topminnows occupy sites both up-and-downstream of the lake. Upstream sites in Cottonwood Spring are protected by a barrier, but Sonoita Creek sites are not protected by barriers, and under some hydrological conditions, rainbow trout may be able to move up the creek toward the Sonoita Creek sites. Downstream, any Gila topminnow in Sonoita Creek is immediately vulnerable to any rainbow trout that moves out of the reservoir, while those in Coal Mine Canyon and Fresno Canyon are above barriers. However, any Gila topminnow above a barrier in the vicinity of Patagonia Lake can move out of the protected reach and be at risk of competition or predation from nonnative species including rainbow trout. Gila topminnow are small enough to be at risk of predation. While Gila topminnow prefer to live in shallow, quiet-water situations where it is less likely they would encounter rainbow trout, in the main channel of Sonoita Creek such habitats may not be available and Gila topminnow may come into contact with rainbow trout in pools where trout are more likely to be located. Competition for food and possible predation on Gila topminnow by rainbow trout may occur in those circumstances.

#### *Peña Blanca Lake*

Annual stocking of 45,000 rainbow trout from November to March would result in this species persisting in the lake during the winter when it may be most likely to spill. High precipitation events in the winter of 2009-2010 caused the near-empty lake to fill and spill down toward the Santa Cruz River. The drainage below the lake is ephemeral; flowing only during spring runoff or monsoon storms and is approximately seven miles from the confluence with the Santa Cruz River, which is perennial at this location due to treated effluent release from the Nogales sewage treatment plant. Water quality in this reach of the Santa Cruz River was poor; however, improvements in the effluent stream due to the upgraded treatment plant have improved water quality, although the permanent water may not reach as far upstream as it did prior to the improvements. The Gila topminnow population in the Santa Cruz River in Arizona is documented both upstream and downstream of the confluence, most recently in 2003. Conditions in the Santa Cruz River are not conducive to provide habitat for rainbow trout during the colder months as it tends to be shallow, but they could persist until the water warmed up and exceeded their thermal tolerance. If rainbow trout were present, there is an opportunity for competition with or predation on Gila topminnow, as we expect Gila topminnow to reestablish in this part of the Santa Cruz. Due to the seasonality of rainbow trout presence, the amount of competition or predation is likely to be very limited.

#### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section

because they require separate consultation pursuant to section 7 of the Act.

Parker Canyon Lake and Peña Blanca Lake are on lands managed by the Coronado National Forest so most activities that could potentially affect Gila topminnow are Federal activities and subject to additional section 7 consultations. Patagonia Lake is on Arizona State Parks lands. We are not aware of any upcoming non-Federal activities that may affect Gila topminnow in the vicinity of the lake; although conservation work for the Gila topminnow under the Gila River Basin Native Fishes Conservation Program is underway.

Use of live baitfish is not allowed at Parker Canyon Lake or Peña Blanca Lake. Threadfin shad are allowed at Patagonia Lake. Waterdogs (tiger salamanders) are legal at Patagonia Lake and Peña Blanca Lake. None of these bait species are usually used for stocked rainbow trout, so the impetus to create populations of these species in the vicinity of the lakes to use for fishing for rainbow trout is limited.

Cross-border violation (CBV) activity in southern Arizona has resulted in route proliferation, off-highway vehicle activity, increased human presence in backcountry areas, discarded trash, abandoned vehicles, cutting of firewood, illegal campfires, and increased chance of wildfire. Additionally, contamination of water sources, including stock tanks used for bathing or waste disposal is of concern for the Gila topminnow.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. Parker Canyon and Patagonia lakes were illegally stocked with sportfish species, and all three have other illegally stocked nonnative fish such as bullheads and green sunfish. The Area-Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to Gila topminnow populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk (Yaqui

topminnow, the other subspecies of Sonoran topminnow, has been infected with Asian tapeworm [USFWS 2008a]). Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect Gila topminnow. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CONCLUSION

After reviewing the current status of Gila topminnow, the environmental baseline for the action area, the effects of the proposed sport fish stocking and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Gila topminnow. No critical habitat has been designated for this species; therefore, none will be affected.

We present this conclusion on Gila topminnow for the following reasons:

- Conservation (reintroduced) populations are all isolated from stocked sportfish moving upstream into occupied habitat. While there is a risk to any Gila topminnow that moves downstream from the secure habitat to be exposed to a stocked sportfish or its progeny, that risk is low. Further, Gila topminnows that move out of the secure habitat cannot re-access the habitat and are assumed lost to the conservation population. This loss is not likely significant to the stability and success of the conservation population.
- The risks of exposure to stocked sportfish or their progeny at the three stocking sites with natural Gila topminnow populations nearby are very low at Parker Canyon Lake, and somewhat more likely for Peña Blanca Lake and Patagonia Lake. The seasonality of rainbow trout stocking at these two lakes, and the physical conditions at the Gila topminnow-occupied sites during the period of exposure limit the potential for adverse interactions. Particularly below Patagonia Lake, there is opportunity for exposure to Gila topminnow from escaped rainbow trout. The number of such potential encounters is likely to be low, and not result in significant adverse effects to the Gila topminnow populations.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Conservation populations: For Gila topminnow to be exposed to stocked sportfish, they must move out of the reintroduction sites downstream to the stocking sites. Gila topminnow, like most native fish species, is fairly resistant to movement during high flows; however, it can be expected that some individuals would be displaced downstream. The number of such individuals transported from any reintroduction site is unknown, but is not likely to be significant. The first condition is met; however, it would be difficult to document the presence of Gila topminnow in the stocking sites. Numerous nonnative predators are present in the stocking sites in addition to the stocked sportfish, including wild populations of the warmwater sportfish species proposed for stocking. The stocked rainbow trout are less likely to be active predators on Gila topminnow than the resident warmwater fish populations. We are unable to be reasonably certain that any predation on Gila topminnow would be the result of the proposed action, thus cannot meet the second condition.
- Natural populations: At Parker Canyon Lake, Patagonia Lake, and Peña Blanca Lake, Gila topminnows are not present at the stocking sites. For exposure to occur stocked sportfish would have to leave the stocking sites and access occupied Gila topminnow habitats. For Parker Canyon Lake and Peña Blanca Lake, exposure is unlikely to occur due to physical constraints on access to the San Rafael Valley and Santa Cruz River occupied habitats, thus the first and second conditions are not met. For Patagonia Lake, rainbow trout can move out of the lake downstream to the confluence with Fresno

Canyon and Gila topminnow can move down Fresno Canyon. As discussed under conservation populations, the first condition is met; however, there are warmwater predators present in this portion of Sonoita Creek. We are unable to be reasonably certain that any predation on Gila topminnow would be the result of the proposed action, thus cannot meet the second condition.

### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for Gila topminnow contingent upon CAMP funding availability as described in the Program document. The ability to implement recovery actions for Gila topminnow under the auspices of the CAMP provides conservation benefits to Gila topminnow that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

#### **Gila trout (*Onchorhynchus gilae*)**

#### DESCRIPTION OF THE PROPOSED ACTION

Gila trout were stocked as conservation populations in 2009 into Grapevine Spring, a tributary of Big Bug Creek which confluent with the Agua Fria River north of Mayer (Fain Lake and Lynx stocking sites); and Frye Creek, a stream in the Pinaleno Mountains that feeds the Frye Mesa Lake stocking site. Gila trout will be stocked into Frye Mesa Lake under the proposed action. Table 6 lists the stocking sites. New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 6: Stocking sites, sportfish species proposed for stocking, and potentially affected Gila trout populations.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking</b>           | <b>Species population affected (R = reestablished)</b> |
|------------------------------|------------------------------------------------|--------------------------------------------------------|
| <i>Agua Fria River</i>       |                                                |                                                        |
| Fain Lake                    | ONMY, SAFO, SATR, LEMA, MISA, POAN, ICPU       | Grapevine Spring (R)                                   |
| Lynx Lake                    | ONMY, ONCL, SAFO, SATR, LEMA, MISA, POAN, ICPU | Grapevine Spring (R)                                   |



|                   |                            |                |
|-------------------|----------------------------|----------------|
| <i>Gila River</i> |                            |                |
| Frye Mesa Lake    | ONMY, ONGI*, SAFO,<br>SATR | Frye Creek (R) |

## STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

### *Listing*

The Gila trout was listed as an endangered species under the 1966 Federal Endangered Species Preservation Act and endangered status continued under the 1973 Endangered Species Act. Gila trout was downlisted to threatened in 2006 based on significant improvements to the species status through implementation of the Recovery Plan that allowed for downlisting.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Gila trout. This information was taken from the 2003 recovery plan (USFWS 2003) and the 2006 reclassification final rule (71 FR 40657; USFWS 2006). Information in these documents is incorporated by reference.

### Life history

Spawning of Gila trout occurs mainly in April, with temperatures of 46°F. Day length may also be a cue for spawning to initiate. Females reach maturity at age two to four, at about six inches or greater. Males reach maturity at age two or three and at approximately the same size.

Gila trout are primarily insectivorous with adult dipterans, aquatic insect larvae or nymphs, and aquatic beetles commonly taken. Gila trout may also be somewhat piscivorous. In streams, they establish a feeding hierarchy in the pools and larger fish would chase away smaller fish.

### Habitat use

Adult Gila trout are mainly found in pools, particularly those over one foot deep with low velocity areas adjacent to higher velocity waters where the individual may forage but not be exposed to the higher velocity waters. Large woody debris is an important component for both pool formation and cover. Subadults are primarily found in riffles.

### Current distribution

The four original pure populations have been replicated at least once; Main Diamond four times, South Diamond once, Whiskey Creek once, and Spruce Creek three times. Two of the Spruce Creek replicates are in Arizona, of which one, Dude Creek, is known to have failed. The other, in Raspberry Creek, may also have failed since no fish were seen in 2007.

### Threats

The Gila trout remains threatened by land management actions and the spread of nonnative aquatic species. As identified in the final rule reclassifying the species to threatened, improper livestock grazing, timber harvest, wildfire, and effects from the introduction of nonnative aquatic organisms continue to be of concern. For nonnative aquatic organisms effects can be from competition and predation with newly arrived species, hybridization with conspecific rainbow trout, and the transmission of parasites and diseases through the introduction of nonnative aquatic species. An example of the latter is the presence of bacterial kidney disease in nonnative brown trout.

#### Conservation actions

Conservation actions for the Gila trout include replicating populations into secure streams that have barriers and were chemically treated to remove nonnative species. Expansion of the species into historical range in Arizona is continuing to promote recovery of the species.

#### *Previous consultations*

Section 7 consultations on Gila trout include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting Gila trout in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

The Gila trout was reintroduced into two streams in Arizona in 2009 to contribute to recovery and into Frye Mesa Lake to provide for sportfishing opportunities in 2010. Each of those reintroduction sites is connected with sportfish stocking sites included in the proposed action. Because these two areas are disjunct, they form two action areas.

The action area for the Grapevine Creek reintroduction site is from Grapevine Springs to the Agua Fria River from Lynx Lake to the USGS stream gage at Mayer. This site was chosen as it is 700 feet downstream of the Agua Fria River confluence with Big Bug Creek, and is at the end of the perennial flow reach due to diversions upstream at the Perry Canal. Grapevine Creek, a tributary to Big Bug creek, has perennial flows for over 1 mile of stream. Flows become

intermittent beyond this point for approximately 0.6 mile and then the stream is dry for over three miles to the confluence of Big Bug Creek. Big Bug Creek is intermittent during the summer months and there are no records of fish in the creek. If a trout did move downstream in an extreme precipitation and flow event, it would not persist in either Big Bug Creek or the Agua Fria due to temperatures above critical tolerance levels and lack of habitat (J. Carter, AGFD, pers. com.).

The action area for the Frye Creek reintroduction site is Frye Creek from its headwaters at Emerald Spring downstream to and including Frye Mesa Lake. Frye Creek is perennial above the lake, and ephemeral below. During spring runoff or summer monsoon events that fill the lake, water spills out down Frye Creek and is halted by levees before it reaches the Gila River. Any fish that get washed out of the lake would not survive.

#### **A. Status of the species and critical habitat within the action area**

Grapevine Creek was historically fishless until November 4, 2009, when Gila trout were stocked into the upper perennial section as a conservation action. If it becomes established, this population counts towards recovery of the species. Subsequent stocking may occur over the course of the next five to ten years. Because Gila trout are a Federal threatened species, AGFD has the ability under the 4(d) rule of the Endangered Species Act to regulate take by allowing limited utilization of reestablished populations as sport fisheries. Grapevine Creek is currently closed to angling while the population becomes established; however, the potential of the Gila trout population in Grapevine Creek to open to angling, once established may be considered in the future if the population is large enough to sustain limited catch-and-release angling pressure.

Gila trout were stocked into Frye Creek upstream of the reservoir as a conservation action on November 4, 2009. It is too early to determine survival of the stocked fish or establishment of a recovery population in either site but these populations will be monitored to determine if the species becomes established. Gila trout were stocked into Frye Mesa Lake in 2010 to create a sportfishery.

Over the 10-year period covered by this consultation, it is anticipated that individual Gila trout (stocked fish or their progeny) will move out of the reintroduction sites to either Big Bug Creek/Agua Fria River or to Frye Mesa Lake. Gila trout will continue to be stocked into Frye Mesa Lake as part of the proposed action.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

Both reintroduction sites were selected because they contained suitable physical habitat conditions for Gila trout, and have few or no nonnative fish species present (Frye Creek was renovated prior to the Gila trout stocking and Grapevine Creek was fishless). The same is not true of portions of the action area outside the reintroduction sites, where nonnative warmwater fish are in the Agua Fria River and nonnative coldwater fish are in Frye Mesa Lake.

The reintroduction sites are both on Federal land (Prescott and Coronado National Forests) and land management on the watersheds is governed by the respective forest land management plan.

Livestock grazing, recreation, and wildfire suppression activities may have effects to the two reintroduction streams.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the Gila trout are in the recovery plan (USFWS 2003). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on Gila trout.

Recovery streams are managed for self-sustaining Gila trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Those recovery stocking actions are not part of the proposed action. Gila trout stocked from the hatcheries for the specific purpose of providing fishing opportunities are part of the proposed action for Frye Mesa Lake. Gila trout stocked for recreational purposes as part of the proposed action are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Gila trout as a Threatened species. That rule allows take of Gila trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.

The effects analysis for the Gila trout is complicated by several factors, among them the 4(d) rule that provides for the development of the recreational fishery. Evaluation of potential impacts to Gila trout must include these factors. These scenarios relate only to effects to Gila trout; effects of stocking Gila trout on other listed or candidate species will be addressed in the analysis of effects for those species elsewhere in this BO. Each stocking site has a combination of these factors to consider in the effects analysis.

1. *Impacts from sport fish species co-stocked with Gila trout in non-recovery areas for the intent of providing angling opportunity.*

In Frye Mesa Lake, Gila trout would usually be stocked along with other nonnative trouts. As described in Appendix D, impacts to stocked Gila trout from co-stocked sport fish species may include predation or competition with all species (at various levels), and/or hybridization with stocked rainbow trout.

2. *Impacts from stocked sport fish species to recovery Gila trout that escape from recovery areas above barriers.*

It is unlikely that Gila trout in Grapevine creek would move downstream into Big Bug Creek or further into the Agua Fria since there is a three mile “dry barrier” upstream from the confluence with Big Bug Creek. Prior to the stocking in November 2009, Grapevine Creek was fishless, and Big Bug Creek is currently fishless indicating that fishes present in the Agua Fria have not been successful at moving into and occupying Big Bug Creek. Consequently, if sport fish stocked in either Lynx or Fain lakes escape and move downstream into the Agua Fria, it is not expected that they would move upstream into Big Bug Creek or Grapevine Creek. However, during high flow years when Gila trout may be washed out of Grapevine Creek, and stocked fish species from Lynx and Fain lakes are washed from those sites down Lynx Creek to the Agua Fria River, there is a potential for exposure that could result in competition with or predation on Gila trout. Any Gila trout that is washed out of the reintroduction site is likely permanently lost to the conservation population since it is unlikely it could swim back upstream due to the intermittent and dry reaches.

Gila trout washed down into Frye Mesa Lake or stocked into Frye Mesa Lake may be subject to competition with and/or possible predation by stocked brown, brook, or rainbow trout and may also hybridize with rainbow trout (although trout reproduction has never been documented in the lake). Gila trout that migrate into the lake will be lost from the recovery population in the stream above because they will not be able to migrate back upstream due to existing natural waterfalls, which also prevent nonnative trout stocked into the lake from accessing the recovery area.

If recovery Gila trout were to move out of designated recovery areas to areas where stocked Gila trout or other stocked species may be present, the “recovery” fish would be considered assimilated into the existing Gila trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Gila trout, and would no longer contribute towards recovery since they were no longer in the recovery stream. Impacts to these individuals would be assessed in the same manner as for stocked Gila trout in non-recovery areas (see #1 above).

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Both reintroduction sites are on Federal Lands, and actions in the watersheds are addressed under land management plans that have undergone section 7 consultation. Water releases from Lynx, Fain, and Frye Mesa lakes are controlled by non-Federal water rights holders. We are not aware of any proposed changes to those rights or their operation at this time. Urban development is likely to continue in the Prescott area near the Agua Fria River. It is unknown if additional groundwater pumping in the Prescott area would affect springflows in Grapevine Creek.

*Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to Gila trout populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include, fish, crayfish, and waterdogs (tiger salamanders). The carrier of Bacterial Kidney Disease (BKD), the gram-positive bacterium *Renibacterium salmoninarum*, occurs in very low amounts trout populations in the upper West Fork Gila River, including the Whiskey Creek population of Gila trout (J. Landye, U.S. Fish and Wildlife Service, pers. comm.). Although the carrier is present, there is no evidence of the disease in any population. Whirling disease is not present in any wild or hatchery population of Gila trout. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CONCLUSION

After reviewing the current status of Gila trout, the environmental baseline for the action area, the effects of the proposed sportfish stocking and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Gila trout. No critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on the Gila trout for the following reasons:

- The Grapevine Creek and Frye Creek conservation populations were created to meet recovery goals for the Gila trout, and, as such, their success or failure does not factor into any jeopardy determination based on natural populations.
- The potential for adverse effects to the conservation populations that could influence the successful establishment of the populations is very low, since stocked nonnative fish species are very unlikely to move into the reintroduction areas to adversely affect the Gila trout.
- The number of Gila trout lost to the conservation populations through downstream movement is considered in the planning for the reintroductions, and is not considered

significant to the population status. Gila trout dispersing to the Agua Fria River from Grapevine Creek would not persist in the river due to summer temperatures and flow conditions. Gila trout from the Frye Creek conservation population that disperse downstream to Frye Mesa Lake become part of the 4(d) rule fishable population along with the Gila trout stocked into the lake for that purpose. Establishing the conservation populations is a significant benefit to the species even if small numbers are lost downstream.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Lynx Lake and Fain Lake: Gila trout are not located at the stocking sites. Stocked sportfish would have to leave the lakes to access the Agua Fria River near the confluence with Grapevine Creek. Gila trout would have to move out of Grapevine Creek to the Agua Fria River. The first condition may, on occasion, be met for either Gila trout or stocked sportfish; however, we are not reasonably certain that both would occur at the same time. So we consider the first condition not to be met. There are other predatory nonnative fish in the Agua Fria River that are resident, and Gila chub that leave

Grapevine Spring are more likely to be exposed to those fish even if sportfish also escape from the lakes. Thus, we are also not reasonably certain that the proposed action would result in take, so the second condition is not met.

The FWS anticipates that all Gila trout that move out of Frye Creek into Frye Mesa Lake will be taken as a result of this proposed action. The incidental take is expected to be in the form of harassment via competition for food and space between Gila trout and the stocked trout species, and harm in the form of predation on small Gila trout by stocked trout, particularly brown trout. Once in the lake, adult Gila trout will be exposed to the stocked trout and compete with them for food and space. Small Gila trout would also compete with the stocked trout, and, if they are small enough, may be preyed on by the larger stocked trout, particularly brown trout as they are the most piscivorous of the three species. Predation on Gila trout by the brook trout and rainbow trout may also occur.

#### EFFECT OF THE TAKE

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

#### REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS (as appropriate)

Due to the nature of the incidental take of Gila trout in Frye Mesa Lake, we have not identified any reasonable and prudent measures and terms and conditions to minimize the effects of the take.

#### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We recommend that macroinvertebrate surveys be done on all future Gila trout recovery streams to ascertain that the normal productivity of the stream is sufficient to support a viable trout population. We also recommend that macroinvertebrate surveys be done on existing Gila trout recovery streams prior to introducing any additional native fish species to ensure that the stream can support viable populations of all species proposed for introduction.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

#### **Humpback chub (*Gila cypha*) and critical habitat**



## DESCRIPTION OF THE PROPOSED ACTION

Humpback chub and critical habitat in the Colorado River and Little Colorado River (LCR) are potentially affected by stocking channel catfish in some stocking sites in the Havasu Creek Complex (Colorado River), Canyon Diablo Complex, White Mountain Complex, and Schoens Complex (all Little Colorado River) (Table 7). New stocking sites or species are indicated with a \*.

Table 7: Stocking sites, sportfish species proposed for stocking, and potentially affected humpback chub populations.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking</b>  | <b>Species population affected</b> |
|------------------------------|---------------------------------------|------------------------------------|
| <i>Havasus Creek</i>         |                                       |                                    |
| Cataract Lake                | ONMY, SATR, ICPU, MISA, LEMA, LEMI    | Havasus Creek                      |
| City Reservoir               | ONMY, SATR, ICPU, MISA*, LEMA*, LEMI* | Havasus Creek                      |
| Dogtown Reservoir            | ONMY, SATR, ICPU*, MISA, LEMA, LEMI   | Havasus Creek                      |
| Santa Fe Tank                | ONMY, SATR, ICPU, MISA*, LEMA*, LEMI  | Havasus Creek                      |
| Kaibab Lake                  | ONMY, SATR*, ICPU, MISA, LEMA*, LEMI* | Havasus Creek                      |
| Russell Tank                 | ONMY                                  | Havasus Creek                      |
| <i>Canyon Diablo</i>         |                                       |                                    |
| Ashurst Lake                 | ONMY, ONCL, SATR, SAFO, THAR, ICPU    | Little Colorado River              |
| Coconino Lake                | ONMY, ONCL, SATR, SAFO, THAR          | Little Colorado River              |
| Francis Short Pond           | ONMY, ICPU, MISA, LEMA, LEMI*         | Little Colorado River              |
| Kinnikinick Lake             | ONMY, ONCL, SATR, SAFO, THAR          | Little Colorado River              |
| Morton Tank                  | ONMY                                  | Little Colorado River              |
| Mud Tank                     | ONMY                                  | Little Colorado River              |
| <i>White Mountain</i>        |                                       |                                    |
| Little Mormon Lake           | ICPU                                  | Little Colorado River              |
| Long Lake (Show Low)         | ONMY                                  | Little Colorado River              |
| Silver Creek                 | ONAP, ONMY                            | Little Colorado River              |
| Sponseller Lake              | ONMY                                  | Little Colorado River              |
| Whipple Lake                 | ICPU                                  | Little Colorado River              |
| <i>Schoen's</i>              |                                       |                                    |
| Fools Hollow Lake            | ONMY, ONAP*, ONCL*, SAFO*,            | Little Colorado River              |

|                                       |                                     |                       |
|---------------------------------------|-------------------------------------|-----------------------|
|                                       | ICPU, LEMA*, MISA*                  |                       |
| Mountain Meadow Recreational Complex* | ONMY, LEMA                          | Little Colorado River |
| Rainbow Lake                          | ONMY, ICPU*, LEMA*, MISA*           | Little Colorado River |
| Scotts Reservoir                      | ONMY, ICPU, LEMA*, MISA*            | Little Colorado River |
| Show Low Creek*                       | ONMY                                | Little Colorado River |
| Show Low Lake                         | ONMY, SAFO, ONCL, ONAP, ICPU, LEMA* | Little Colorado River |
| Woodland Lake                         | ONMY, ICPU, LEMA*                   | Little Colorado River |

#### Conservation measures included in the proposed action

While implementing the Integrated Fisheries Management Plan for the Little Colorado River (Young et al. 2001), AGFD will incorporate concerns expressed in Stone et al. (2007), Hilwig et al. (2009) and Valdez and Thomas (2009) regarding the Little Colorado River drainage above Grand Falls as a source of nonnative fish species (particularly channel catfish) into occupied humpback chub habitat in the lower Little Colorado River (non-mandatory measure).

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

Humpback chub were listed as an endangered species on March 11, 1967 (32 FR 4001). Critical habitat for humpback chub was designated in 1994 (59 FR 13374; USFWS 1994). Seven reaches of the Colorado River system were designated as critical habitat for humpback chub for a total river length of 379 miles in the Yampa, Green, Colorado, and Little Colorado rivers. Known constituent elements include water, physical habitat, and biological environment as required for each life stage. Water includes a quantity of sufficient quality (i.e. temperature, dissolved oxygen, lack of contaminants, nutrients, and turbidity) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage. Physical habitat includes areas of the Colorado River for use in spawning, nursery, feeding, and rearing, or corridors to these areas. The biological environment includes food supply and habitats with levels of nonnative predators and competitors that are low enough to allow for spawning, feeding, and rearing.

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the humpback chub. This information was taken from the 2008 biological opinion for the operation of Glen Canyon Dam (USFWS 2008d) and the 2009 supplement to that biological opinion (USFWS 2009d). Information in these documents is incorporated by reference.

Of particular importance is the discussion of status and importance of designated critical habitat units to the conservation of the humpback chub.

## Life history

The humpback chub is a medium-sized freshwater fish (to about 20 inches) of the minnow family, Cyprinidae. The adults have a pronounced dorsal hump, a narrow flattened head, a fleshy snout with an inferior-subterminal mouth, and small eyes. It has silvery sides with a brown or olive-colored back. The humpback chub is endemic to the Colorado River Basin and is part of a native fish fauna traced to the Miocene epoch in fossil records (Miller 1955, Minckley et al. 1986). Likely because of its preference for remote, whitewater canyons in the Basin, humpback chub was first described as a species in the 1940s (Miller 1946), so its original distribution outside of currently known occupied areas is unknown.

The life history and ecology of the humpback chub is detailed in the Recovery Goals (USFWS 2002d) and the 2008 biological opinion (USFWS 2008d) and that information is incorporated by reference.

## Current status

There are six populations of humpback chub in the Colorado River basin; five in the upper basin, and one in the lower basin. The status of the five populations of humpback chub located above Glen Canyon Dam in the Upper Colorado River Basin was described in the 2008 biological opinion (USFWS 2008d). These populations include three in the Colorado River: at Cataract Canyon, Utah; Black Rocks, Colorado; and Westwater Canyon, Utah; one in the Green River in Desolation and Grey canyons, Utah; and one in the Yampa River in Yampa Canyon in Dinosaur National Monument, Colorado. Population estimates for humpback chub using mark-recapture estimators began in 1998 with the Black Rocks and Westwater Canyon populations, and were conducted during 1998-2000 and 2003-2005. These estimates show the Black Rocks population between about 1,000 and 2,000 adults (age 4+) and the Westwater Canyon population between about 1,700 and 5,100 adults (McAda 2004, 2006, 2007, Hudson and Jackson 2003). Population estimates for Desolation/Gray Canyon in 2001-2003 show the population between about 1,000 and 2,600 adults (Jackson and Hudson 2005). The Cataract Canyon population was recently estimated at about 100 adults. In Yampa Canyon, too few adults were captured to estimate population size (Finney 2006, Badame 2008).

As reported in the 2008 biological opinion, mark-recapture methods have been used since the late 1980s to assess trend in adult abundance and recruitment of the LCR aggregation of humpback chub, the primary aggregation constituting the Grand Canyon population, the only population in the lower Colorado River basin. These estimates indicate that the adult population declined through the 1980s and early 1990s but has been increasing for the past decade (Coggins et al. 2006a, Coggins 2008a, Coggins and Walters 2009). Coggins (2008a) summarized information on abundance and analyzed monitoring data collected since the late 1980s and found that the adult population had declined from about 8,900- 9,800 in 1989 to a low of about 4,500-5,700 in 2001. Current methods for assessment of humpback chub abundance rely on the Age-Structured Mark-Recapture model (ASMR) (Coggins et al. 2006b, Coggins and Walters 2009). Although Coggins and Walters (2009) caution that the ASMR has limited capability to provide abundance estimates, and that the most important finding in their report is that the population trend in humpback chub is increasing, they conclude that “considering a range of assumed

natural mortality-rates and magnitude of ageing error, it is unlikely that there are currently less than 6,000 adults or more than 10,000 adults” and estimate that the current adult (age 4 years or more) population is approximately 7,650 fish. This is an increase from the 2006 estimate of 5,300-6,700 (Coggins 2008a).

Translocation of juvenile humpback chub from near the mouth of the LCR upstream to above Chute Falls was undertaken from 2003-2005 (December 2002 Section 7 Consultation 02-21-03-F-016) and from 2008 -2010 as a conservation measure of the 2008 biological opinion. In 2008, 299 juvenile humpback chub were translocated, and an additional 194 were moved in 2009. Most recently in July 2010, 111 fish were moved above Chute Falls. The purposes of the conservation measure are to extend the range of the species upstream in the LCR into reaches previously unoccupied by significant numbers of humpback chub, to improve the survivorship of juvenile humpback chub by moving juveniles to areas of the LCR with better nursery habitats, and to glean information on the life history of the species. Monitoring of this upstream reach has also been conducted yearly since 2003. Translocation also took place into Shinumo Creek in June 2009 and in June 2010, where 300 juvenile humpback chub in each year were translocated. In addition, starting in 2008, fish are being collected to develop a genetic refuge at Dexter National Fish Hatchery and Technology Center. This refuge serves as a redundant, off-channel population should a catastrophic loss occur in the LCR. Currently 480 fish reside at Dexter for refuge purposes with plans to add an additional 200 fish per year until the population reaches 1000 fish.

#### Conservation actions

The Upper Colorado River Endangered Fish Recovery Program (UCRRP) is an ongoing effort to provide conservation that leads to the recovery of the humpback chub. The Glen Canyon Adaptive Management Program (GCDAMP) in Grand Canyon is primarily focused on mitigation measures to offset effects of the operation of Glen Canyon Dam, but those actions do provide conservation benefits.

#### *Previous consultations*

Section 7 consultations on humpback chub include those for management of water in the Upper Colorado River Basin and Glen Canyon Dam and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting humpback chub in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### *Critical Habitat*

Critical habitat for humpback chub was designated in 1994 (59 FR 13374; U.S. Fish and Wildlife Service 1994). Seven reaches of the Colorado River system were designated for a total river length of 379 miles in the Yampa, Green, Colorado, and Little Colorado rivers in Arizona, Colorado and Utah. “Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on

which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species’ eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (USFWS and NMFS 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

Recovery for the humpback chub is currently defined by the FWS Humpback Chub Recovery Goals (USFWS 2002d, 2009e). In 2006, a U.S. District Court ruling set aside the recovery goals, essentially because they lacked time and cost estimates for recovery. The court did not fault the recovery goals as deficient in any other respect, thus the FWS and the GCDAMP, and the UCRRP, continue to utilize the underlying science in the recovery goals. This supplemental opinion therefore relies on the draft 2009 revisions to the recovery goals to define recovery (Recovery Goals) (USFWS 2009e) as those goals represent the best available scientific information. The Recovery Goals provide measureable recovery criteria which were not available at the time of the 1995 Opinion.

The Recovery Goals define recovery as specific demographic goals that must be attained, and recovery factors that must be met to achieve downlisting and delisting of humpback chub. The recovery factors were derived from the five listing threat factors and state the conditions under which threats are minimized or removed sufficient to achieve recovery; a list of site-specific management actions and tasks is also provided to assist in meeting recovery factors. The management actions and tasks consist of specific actions (e.g. the development and implementation of nonnative fish control programs). They also include the need to identify, implement, evaluate, and revise (as necessary through adaptive management) flow regimes to benefit humpback chub for all the rivers in which the species occurs. Essentially, the goals identify actions (management actions and tasks and associated recovery factor criteria) needed to maintain the habitat features (i.e. the PBFs of critical habitat) to accomplish recovery. But the measure of whether or not actions are working with regard to recovery, and the basis for altering management actions through adaptive management, are the demographic criteria. The site-

specific management actions and tasks and recovery actions, as well as the demographic Recovery Goals, are provided in USFWS 2002d and are in Appendix B of the 2009 biological opinion (USFWS 2009d). We summarize here the Recovery Goal demographic criteria for downlisting as follows (population demographics in both recovery units must be met in order to achieve downlisting):

Upper basin recovery unit

1. Each of the five self-sustaining populations is maintained over a 5-year period, starting with the first point estimate acceptable to the Service, such that:
  - a. the trend in adult (age 4+;  $\geq 200$  mm TL) point estimates does not decline significantly, and
  - b. mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
2. One of the five populations (e.g., Black Rocks/Westwater Canyon or Desolation/Grey Canyons) is maintained as a core population such that each point estimate exceeds 2,100 adults (Note: 2,100 is the estimated MVP number; see section 3.3.2 of the Recovery Goals).

Lower basin recovery unit

1. The Grand Canyon population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the Service, such that:
  - a. the trend in adult (age 4+;  $\geq 200$  mm TL) point estimates does not decline significantly, and
  - b. mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
  - c. each core population point estimate exceeds 2,100 adults (MVP).

The Recovery Goal demographic criteria for delisting are as follows:

Upper basin recovery unit

1. Each of the five self-sustaining populations is maintained over a 3-year period beyond downlisting, starting with the first point estimate acceptable to the Service, such that:
  - a. the trend in adult (age 4+;  $\geq 200$  mm TL) point estimates does not decline significantly, and
  - b. mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
2. Two of the five populations (e.g., Black Rocks/Westwater Canyon and Desolation/Grey Canyons) are maintained as core populations such that each point estimate exceeds 2,100 adults (MVP).

Lower basin recovery unit

1. The Grand Canyon population is maintained as a core over a 3-year period beyond downlisting, starting with the first point estimate acceptable to the Service, such that:
  - a. the trend in adult (age 4+;  $\geq 200$  mm TL) point estimates does not decline significantly, and
  - b. mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
  - c. each core population point estimate exceeds 2,100 adults (MVP).

Because the Recovery Goals consist of actions to improve habitat and minimize threats that are ultimately measured for success by the status and trend (i.e. the demographic state) of the population through adaptive management, we have evaluated the contribution of each critical habitat unit by examining how the PCEs are, or are not, serving to achieve the demographic criteria. In some cases, population-dynamics information is not statistically adequate to evaluate the demographic goal as defined in the Recovery Goals. In those cases, we rely on what data there are to make an informed, albeit subjective, evaluation of the PCE/critical habitat unit.

#### General PBFs

Critical habitat was listed for the four big river fishes (Colorado pikeminnow humpback chub, bonytail, and razorback sucker) concurrently in 1994, and the PBFs were defined for the four species as a group (USFWS 1994b). However, note that the PBFs vary somewhat for each species on the ground, particularly with regard to physical habitat, because each of the four species has different habitat preferences.

Water--Consists of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) (W1) that is delivered in sufficient quantity to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species (W2).

Physical Habitat--This includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning (P1), nursery (P2), feeding (P3), or corridors between these areas (P4). In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding, and rearing habitats, or access to these habitats.

Biological Environment--Food supply (B1), predation (B2), and competition (B3) are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, is out of balance due to introduced fish species in some areas. This is also true of competition from nonnative fish species.

The PBFs are all integrally related and must be considered together. For example, the quality of water and quantity of water (PBF W1 and W2) affect the food base (PFB B3) directly because

changes in water chemistry, turbidity, temperature, and flow volume all affect the type and quantity of organisms that can occur in the habitat that are available for food. Likewise, river flows and the river hydrograph have a significant effect on the types of physical habitat available. Changes in flows and sediment loads caused by dams may have affected the quality of nearshore habitats utilized as nursery areas for young humpback chub.

Increasingly the most significant PBF seems to be the biological environment, and in particular PBFs B2 and B3, predation and competition from nonnative species. Even in systems like the Yampa River, where the water and physical PBFs are relatively unaltered, nonnative species have had a devastating effect on the ability of that critical habitat unit to support conservation (Finney 2006, Fuller 2009). In fact, as we will describe in more detail, the conservation of humpback chub in the future will depend on our ability to control nonnative species, and manipulating the water and physical PBFs of critical habitat to disadvantage nonnatives may play an important role.

The 2009 biological opinion (USFWS 2009d) described in detail how the PBFs were met in each critical habitat unit. We incorporate that information by reference.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

There are two action areas for the humpback chub; the first contains the Havasu Creek watershed and the portion of the Colorado River within 10 miles upstream and downstream of their confluence. The mainstem Colorado River section is in the Marble and Grand Canyon critical habitat reach. This is the site for the six Havasu Creek sportfish stocking sites.

The second is the mainstem Little Colorado River and its tributaries containing the Canyon Diablo, White Mountain, and Schoens complexes sportfish stocking sites. The Little Colorado River critical habitat reach is included in this action area.

#### *Havasut Creek*

#### **A. Status of the species and critical habitat within the action area**

The 2009 biological opinion (USFWS 2009d) contains a detailed description of the status of the humpback chub in the mainstem Colorado River and the status and conservation value of the critical habitat. We incorporate that material by reference. In this section we shall briefly describe the situation as regards nonnative species in this reach as it is the relevant issue for this



consultation.

There are limited fish survey data for Havasu Creek itself. On the Havasupai Reservation, there are no recent surveys. Below the reservation and above the confluence, surveys were conducted between 1978 and 2003 and most recently in 2011. Other surveys in the mainstem near Havasu Creek are conducted yearly. The only nonnative species taken in lower Havasu Creek that are proposed for stocking in the watershed are rainbow trout, brown trout, and channel catfish, with only one channel catfish and two brown trout recorded and those were taken in the lowest one-kilometer reach nearest the confluence. Of the 117 rainbow trout taken between 1978 and 2003, 116 were in the lowest one-kilometer reach and one between the 2-3 km reach. The 2010 surveys captured 10 rainbow trout (specific locations in the creek not provided), including two ripe males (Sponholtz 2010). All capture locations for trout were below Beaver Falls on NPS managed lands. Largemouth bass and redear sunfish have not been detected in fish surveys in Havasu Creek but largemouth bass have been reported from the Colorado River in Grand Canyon below Havasu Creek and are likely moving up from the Lake Mead population. Green sunfish and black crappie, common in several reservoirs within the watershed, have not been detected in Havasu Creek. Rainbow trout, brown trout, and channel catfish all have reproducing populations in the Colorado River, though they may not be reproducing in the vicinity of Havasu Creek. Humpback chub are also found in this reach of the Colorado River and there is a small spawning aggregation present. In summer 2011, wild humpback chub were found below Beaver Falls, the first time humpback chub have been documented in Havasu Creek above the confluence with the Colorado River. Subsequent to the documentation of these wild fish, 243 age 1 humpback chub were translocated into the creek below Beaver Falls to augment this population (Sponholtz 2011).

The three nonnatives (rainbow trout, brown trout, and channel catfish) are all identified as predators on small humpback chub (Valdez and Ryel 1995, Hilwig et al. 2009 and others). Monitoring to evaluate populations of these species in the Colorado River is ongoing, along with efforts at mechanical removal of rainbow trout and evaluations of removal potentials for channel catfish (Hilwig et al. 2009). The normal monitoring using electrofishing, seining, and hoop-netting appears sufficient to track and evaluate populations of rainbow trout and brown trout; however, channel catfish are not well documented by these methods, with the result that populations may be underestimated. Use of different types of hoop-nets and bait showed promise in capturing more channel catfish, but the results were not consistent and additional work is needed (Hilwig et al. 2009).

Channel catfish are the species of concern for this evaluation. They are robust and can survive being carried in floodwaters (Stone et al. 2007) and are proposed for stocking in the five lakes in the vicinity of Williams, Arizona as part of this action. They have been rarely found in lower Havasu Creek (one record) but are consistently taken in the mainstem Colorado in the vicinity of the creek. Mainstem data from 1998-2008 (note: because all surveys are consistently done the same way each year, even if the methods are not particularly effective at capturing channel catfish, this does provide information on relative abundance if not population size) indicates that near Havasu Creek (river mile 158) there are few channel catfish. In the area around the Little Colorado River (rm 61) and below Diamond Creek (rm 225.7) populations are much higher. Ackerman (2008) in reporting on survey data from 2002-2006, showed that populations of

channel catfish in the river increased below Havasu Creek with numbers highest closest to Lake Mead.

The biological environment PBF for food base (B1) appears met for adult humpback chub, but may be limiting for juveniles. PBFs B2 (competition) and B3 (predation) are a serious issue for conservation of humpback chub, and may not be met with regard to juvenile humpback chub and the effect of nonnative fish predation on humpback chub recruitment in Reach 7. However, there appears to be an important relationship between the effects of dam operations on the water and physical PBFs of critical habitat.

The demographic goal for the Grand Canyon population for downlisting is that the humpback chub population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the Service, such that the trend in adult (age 4+;  $\geq 200$  mm TL [7.9 inches]) point estimates does not decline significantly, the mean estimated recruitment of age-3 (150–199 mm TL [5.9 to 7.8 inches]) naturally produced fish equals or exceeds mean annual adult mortality, and the population point estimate exceeds 2,100 adults (USFWS 2009e). The FWS has not yet determined that the demographic goal for the Grand Canyon population has been met, but the best available science indicates the population is nearing this demographic criterion. Given this, the mainstem Colorado River in Marble and Grand canyons, i.e. Reach 7 and its PBFs, appear to be meeting the needs of recovery. Nevertheless, many questions remain about the role of the mainstem in recovery, and how best to improve the PBFs in this reach to best promote recovery. These questions are outlined in the Recovery Goals and are currently the focus of a number of monitoring and research efforts of the GCDAMP.

## **B. Factors affecting the species' environment and critical habitat within the action area**

The effects of construction and operation of Glen Canyon Dam and the effects of nonnative fish on the humpback chub population in Grand Canyon have been well documented, including in recent biological opinions (USFWS 2008d, 2009d). The aggregate effects are responsible for the current status of the humpback chub and its critical habitat in the action area.

### **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the humpback chub are in the recovery goals document (USFWS 2002d). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked

sportfish species on humpback chub.

Five of the six stocking sites in this complex are located on the upper watershed of Cataract Creek near the town of Williams. The sixth is northeast of Williams on a tributary to Cataract Creek. Cataract Creek is the major tributary to Havasu Creek which enters the Grand Canyon through the Havasupai Indian Reservation.

Species proposed to be stocked are rainbow trout, brown trout, channel catfish, largemouth bass, bluegill, and redear sunfish. The five sites near Williams have all species proposed; Russell Tank north east of Williams is rainbow trout only. The issue of concern is whether or not the stocked fish could be transported from the stocking sites to the humpback chub and critical habitat in the Colorado River. None of the new stocking species proposed for City Reservoir, Dogtown Reservoir, Santa Fe Tank, and Kaibab Lake are new to the drainage, and, in fact, all are continuing species in other stocking sites in the drainage.

The Cataract Creek watershed below the stocking sites is ephemeral. Perennial flows do not appear below the confluence of Cataract Creek with Havasu Creek, until approximately nine miles above the Colorado River confluence. The Williams area sites (Cataract Lake, City Reservoir, Dogtown Reservoir, Kaibab Lake, and Santa Fe Reservoir) store water from storms and spill perhaps three of every 10 years. The spill history of Russell Tank is not known, but there is a defined tributary downstream of the Tank that can convey water.

There are three factors to consider in determining the degree of connectivity and subsequent exposure to humpback chub and critical habitat:

1. Distance and surface water: The Williams area stocking sites are 135 miles above the confluence of Havasu Creek and the Colorado River. Russell Tank is more than 120 miles above that confluence. The Cataract Creek drainage is ephemeral and only flows after precipitation events or seasonal runoff, so most of the time it is dry. There are some tanks in the channel that can retain water; particularly Redlands Dam located 45 miles above Supai on the Havasupai Reservation. Those tanks could hold fish carried down from higher in the drainage.
2. Flood events: The Williams area sites are filled by precipitation and seasonal runoff events, and spill into Cataract Creek approximately three of 10 years. The volume of those spills likely varies significantly from event to event. There is limited USGS streamflow gage data for upper Cataract Creek. One gage (09404040) near Williams operated from 1965-1972. The drainage area above the gage includes all five lakes and is approximately 46 square miles based on the gage location. Over this period, there were three events that might have provided connectivity to the Colorado River. Peak flows of 2,270 cubic feet per second (cfs) were recorded on November 25, 1965, 646 cfs on December 7, 1966, and 775 cfs on December 26, 1971. All these flows were of very short duration; the 1965 flood had one day of mean discharge over 750 cfs out of seven days with higher than base flows (range of other six days 1.0 to 47 cfs) and the 1966 event only having three days of highest flows (129 to 346 to 85 cfs) and seven days with higher than base flows (range 1.4 to 24). Unfortunately, there are no data from Havasu

Creek reflecting this time period; gages on the creek were not installed until 1990, so a comparison of events to determine connectivity is not possible. However, the significance of flows from this upper portion of the watershed to flows in Havasu Creek above the Colorado River can be estimated by comparing the 46 square mile drainage area to the 2,809 square mile drainage area above the Havasu Creek at Supai gage (09404110). The upper watershed is too small relative to the total drainage area to be a significant contributor to flood flows in the drainage. Further, with the five reservoirs in place to capture surface flow, there is less water available to flow downstream and connect to other tributaries, further reducing the opportunity for connectivity.

3. Fish movement: During spills of the reservoirs, there is opportunity for fish in the reservoir to be displaced out of the reservoir and move downstream with the flows. The ability of a fish to survive in the outflow depends on a number of factors, including the volume of water, speed of the flows, the length of time the flow exists, and the channel conditions or other hazards (significant waterfalls, extremely rocky sections, high sediment loads) that exist. Some fish species are more robust and have a greater potential to survive, others are unlikely to survive. Size of the individual fish is also a factor in survival, with large-bodied fish more susceptible to damage, though they are also more able to find and hold in eddies and other slower moving waters in the stream. We generally consider that more fragile fish such as the trouts are much less likely to survive the trip to lower Havasu Creek than more robust species such as channel catfish.

With the above considerations in mind, there is a potential for connectivity between the stocking sites and the Colorado River. However, this risk is low, and while there is opportunity for fish stocked into the sites to move downstream during flood events, this is likely to be an infrequent occurrence. Further, as shown in the August 2008, flood event, the size of a flood necessary to connect the entire drainage is such that velocities and sediment loads associated with such events are very likely to kill any fish, including channel catfish that are caught in the flood.

For critical habitat, the proposed action is not likely to contribute additional nonnative predators to the existing populations in the mainstem Colorado River. Thus, changes to PBFs B2 and B3 are not anticipated, so the conservation value of the critical habitat is not impaired by the proposed action.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The stocking sites and the headwater areas of Havasu Creek are on a mix of Kaibab National Forest, private, and state lands with the lower end of the watershed on lands belonging to the Havasupai Tribe and at the lowest end, Grand Canyon National Park. We have not identified any non-Federal actions in the Havasu Creek action area that may have impacts to the humpback chub or its critical habitat.

*Little Colorado River***A. Status of the species and critical habitat within the action area**

The 2009 biological opinion (USFWS 2009a) contains a detailed description of the status of the humpback chub in the Little Colorado River and the status and conservation value of the critical habitat. We incorporate that material by reference.

Coggins and Walters (2009) recently assessed the status and trend of the humpback chub in the LCR (the LCR Inflow aggregation) utilizing the ASMR and found that the population size continues to increase, and is now between 6,000 adults and more than 10,000 adults, and estimate the current adult (age 4 years or more) population is approximately 7,650 fish. This is an increase from the 2006 estimate of 5,300-6,700, and an increase of about 50 percent since 2001 (Coggins 2008a, Coggins and Walters 2009). Coggins and Walters (2009) found that the additional data analyzed in the ASMR continue to indicate a decline in the status of the humpback chub since monitoring began in 1989 that reached its lowest point in 2001, and then began to reverse and increase. The change in status was due to an increase in recruitment that began before many actions predicted to improve its status such as mechanical removal of nonnative fishes or warming of mainstem water temperatures in the Colorado River. Mainstem warming and mechanical removal effects both started in 2003 and could have begun affecting the abundance of age-2 recruits in 2004 and later, (brood-years 2002 and later). But the increase in recruitment appears to have at least doubled from the mid-1990s before the population was exposed to warmer Colorado River water temperatures and reduced nonnative abundance near the mouth of the LCR. However, Coggins and Walters (2009) state that the low summer steady flow conducted during the summer of 2000 (primarily a low flow of 8,000 cfs from June to September; see Ralston and Waring 2008), which warmed the mainstem river, may have resulted in increased recruitment of the 1999, 2000, and possibly 1998 brood-years. The increase in recruitment in the 1990s could also have been due to the implementation of the MLFF. Although the contribution of the mainstem aggregations, other than the LCR Inflow aggregation, to the overall Grand Canyon population is not known, and most of the population likely occurs in the LCR Inflow aggregation, the Grand Canyon population of humpback chub (i.e. the lower Colorado River basin recovery unit) is nevertheless the largest of the humpback chub populations, and the only one with an increasing trend. It is important to note that population-dynamics information for humpback chub is much improved since the 1995 opinion, with much more available information on humpback chub recruitment and abundance since the time of the 1995 Opinion, as a result of ongoing monitoring of the GCDAMP and the development of the ASMR (Coggins and Walters 2009).

FWS monitoring efforts in the LCR in 2008 and 2009 also indicate increasing recruitment and abundance. Despite three months of flooding in the LCR in early 2008, the Spring 2008 monitoring found the highest captures of unique humpback chub  $\geq 150$  mm TL (5.9 inches) since semiannual, mark-recapture stock assessments were first initiated in the LCR in 2000 (Stone 2008a). Van Haverbeke and Stone (2009) also note that the 2007 and 2008 estimates of abundance are also statistically comparable to the 1992 spring abundance estimates obtained by Douglas and Marsh (1996). This is significant because the Recovery Goals require an increasing

trend relative to prior abundance estimates (USFWS 2009), and Douglas and Marsh (1996) provided one of the earliest robust estimates of humpback chub abundance in the LCR. Thus it now appears that humpback chub have returned to levels of abundance first documented in the early 1990s. As a caveat to this, there is some evidence to indicate continued decline of the oldest adult chub in the population, the largest fish, age 11 years and older; however, this could be an artifact of earlier declines in population trend such that the recent increase in recruitment and abundance has yet to result in an increase in this largest and oldest size class (R. Johnson, Grand Canyon Trust, pers. comm., 2009).

The abundance of nonnative rainbow trout in the important LCR inflow reach has apparently increased since the 2008 biological opinion was completed (Makinster et al. 2009a, 2009b). Mainstem fish monitoring detected increases in nonnative rainbow trout in the LCR inflow reach of the Colorado River in 2008, prompting a removal trip in May of 2009. AGFD removed 1,873 rainbow trout during the May 2009 removal trip, which is about the same abundance encountered in February of 2003. This indicates that rainbow trout are likely increasing throughout Marble Canyon, and in fact AGFD found more rainbow trout in the control reach upstream of the removal reach than had previously been detected.

Channel catfish are a component of the nonnative fish community in the LCR and the adjacent Colorado River. Immigration of nonnative fish from the LCR watershed to the occupied humpback chub habitats in the LCR has been documented (Stone et al. 2007).

Although the biological PBF for food supply (B1) is met in this reach, there appears to be greater food availability for adult humpback chub in the mainstem Colorado River based on body condition. Hoffnagle (2000) reported that condition and abdominal fat were greater in the mainstem Colorado River than in the LCR during 1996, 1998, and 1999. Alternatively, this may have been due to the increased prevalence and abundance of parasites (especially *Lernaea cyprinacea* and *Bothriocephalus acheilognathi*) in the LCR fish as opposed to greater food availability in the Colorado River.

The biological PBFs of predation (B2) and competition (B3) from nonnative species are largely met. Nonnative fish species that prey on and compete with humpback chub are present, but in very low numbers relative to native fishes including humpback chub (see Tables 6 and 7). For example, although channel catfish captures increased between the spring and fall 2008 monitoring trips (from one fish in spring to 66 fish in the fall), even the increased number of channel catfish captured (n=66) was a small fraction of the total number of humpback chub captured (n=3,084) (Stone 2008a, 2008b). Although fish remains were found in nonnative species in 2007 in the LCR, no direct evidence of humpback chub predation was documented, although predation on humpback chub by catfish and trout has been documented in the past (Marsh and Douglas 1997, Yard et al. 2008). The primary indication that the biological, as well as the other PBFs, are met is the increasing abundance of humpback chub and recruitment that has characterized the population in the LCR in recent years (Stone 2008a, Stone 2008b, Coggins and Walters 2009).

## **B. Factors affecting the species' environment and critical habitat within the action area**

The effects of construction and operation of Glen Canyon Dam and the effects of nonnative fish on the humpback chub population in the Little Colorado River have been well documented, including in recent biological opinions (USFWS 2008a, 2009a). The aggregate effects are responsible for the current status of the humpback chub and its critical habitat in the action area.

## EFFECTS OF THE ACTION

### *Canyon Diablo Complex*

This complex contains six stocking sites; Mud Tank, Kinnickinick Lake, Morton Lake, Coconino Lake, Ashurst Lake, and Francis Short Pond. Of these sites, Coconino and Ashurst Lakes make up a closed system; when they spill, the water is contained in a large, wet meadow with no outlet. Although channel catfish are proposed for stocking at Ashurst Lake, this is a closed system and escapement to the drainage will not occur. Channel catfish are also unlikely to reproduce successfully in Ashurst Lake, so a self-sustaining population will not be established. This site will not be considered further in this analysis. Mud Tank, Kinnickinick Lake, and Morton Lake are in a connected drainage to Grapevine Canyon then to Diablo Canyon. Diablo Canyon is a tributary to the Little Colorado River above Grand Falls. The Canyon Diablo watershed is ephemeral, flowing only after significant precipitation events or spring runoff and confluences with the Little Colorado River approximately 24 miles above Grand Falls. Francis Short Pond is an urban fishing area that spills to San Francisco Wash, a tributary of Diablo Canyon. In the lakes that are not closed systems the following species are stocked: rainbow trout (all), brown trout, brook trout, cutthroat trout, arctic grayling (other trouts only at Kinnickinick Lake), and channel catfish, bluegill, redear sunfish, largemouth bass only at Francis Short Pond. Redear sunfish is a new species for Francis Short Pond. Of the stocking sites with hydrological connectivity, only Francis Short Pond contains channel catfish, the species of concern for humpback chub.

There are three factors to consider in determining the degree of connectivity and subsequent exposure to humpback chub and critical habitat:

1. Distance and surface water: Francis Short Pond is two acres and is filled by runoff and, when needed, reclaimed water from the City of Flagstaff. Francis Short pond spills during spring runoff or high-precipitation events. Water from spill events must cross roads, go through culverts, and a number of small ponds or tanks including a number of sewage disposal ponds. It is approximately 65 miles of mostly ephemeral washes to the Little Colorado River and an additional 114 miles to Blue Springs.
2. Flood events: Francis Short Pond has an approximately 47 square mile drainage area of the Rio de Flag below the San Francisco Peaks and while the pond does flood, there is little to no connectivity to the Little Colorado River.
3. Fish movement: During spills of the lakes, there is opportunity for fish to be displaced out of the lake and move downstream with the flows. The ability of a fish to survive in the outflow depends on a number of factors, including the volume of water, speed of the flows, the length of time the flow exists, and the channel conditions or other hazards

(significant waterfalls, extremely rocky sections, high sediment loads) that exist. Some fish species are more robust and have a greater potential to survive; others are unlikely to survive. Size of the individual fish is also a factor in survival, with large-bodied fish more susceptible to damage, though they are also more able to find and hold in eddies and other slower moving waters in the stream. We generally consider that more fragile fish such as the trouts are much less likely to survive the unlikely trip to the Little Colorado River than more robust species such as channel catfish.

With the above considerations in mind, there is very limited potential for connectivity between the stocking sites in this drainage and the Little Colorado River. The only site with potential connectivity and warmwater fish species is Francis Short Pond, and it is unlikely that any fish from that pond could access the Little Colorado River. The conservation measure included in the proposed action to continue to assess native and nonnative fisheries management in the Little Colorado River basin (Young et al. 2001) will assist in evaluating the risks to the Little Colorado River population of humpback chub associated with channel catfish stocking in the Canyon Diablo watershed.

#### *White Mountain Complex*

This complex contains five stocking sites; four lakes and one stream. One site, Sponseller Lake, is not directly connected to Silver Creek and is a closed system that does not spill. The Silver Creek site is connected to White Mountain Lake by perennial flows. Little Mormon Lake is on Rocky Arroyo, an ephemeral wash that flows in the spring and enters White Mountain Lake six miles downstream of Little Mormon Lake. Water in Little Mormon Lake is diverted from Rocky Arroyo for storage and later release to White Mountain Lake. There is a grate on the outflow structure at Little Mormon Lake that would prevent adult channel catfish (the proposed action is to stock only adult channel catfish) from leaving the lake. If stocked channel catfish persisted and spawned, their progeny could move from the lake. The channel catfish in White Mountain Lake are naturally reproducing, thus it may be likely that they can reproduce in Little Mormon Lake, although Little Mormon Lake has virtually no spawning habitat for channel catfish, which prefer cover in which to lay and protect their eggs. Since channel catfish are already established at White Mountain Lake any contribution of escaped progeny if it were to happen would not be an important factor since there is already a self-sustaining population of channel catfish in the lake. Whipple Lake and Long Lake are fed by overflows from Little Mormon Lake, and once the water reaches them, it cannot be returned to Little Mormon Lake. Effectively, Whipple Lake and Long Lake are closed systems. Rainbow trout are proposed for Sponseller Lake, Silver Creek, and Long Lake; Apache trout for Silver Creek; and channel catfish for Whipple Lake and Little Mormon Lake. There are no new stocked species for any stocking site in this drainage.

There are three factors to consider in determining the degree of connectivity and subsequent exposure to humpback chub and critical habitat:

1. Distance and surface water: Silver Creek is perennial from the stocking site to White Mountain Lake. White Mountain Lake regularly spills during spring runoff and Silver Creek, for 18.6 miles below the lake, is mostly perennial due to runoff and releases of water from the lake during the irrigation season (April 15-September 15). It is mostly



perennial for the last 22.5 miles to its confluence with the Little Colorado River. Rocky Arroyo is ephemeral, with water in the spring runoff period and again during the irrigation season when water may be released to White Mountain Lake for irrigation purposes downstream. The Little Colorado River is mostly perennial from the confluence with Silver Creek to Holbrook, and then is ephemeral to the confluence with Chevelon Creek.

2. Flood events: The Little Colorado River above Grand Falls is seasonally connected to the lower Little Colorado and Colorado Rivers during spring runoff and large precipitation events. Spills from White Mountain Lake are part of that seasonal connectivity.
3. During spills and irrigation releases from White Mountain Lake, there is opportunity for fish to be displaced out of the lake and move downstream with the flows. The ability of a fish to survive in the outflow depends on a number of factors, including the volume of water, speed of the flows, the length of time the flow exists, and the channel conditions or other hazards (significant waterfalls, extremely rocky sections, high sediment loads) that exist. Some fish species are more robust and have a greater potential to survive, others are unlikely to survive. Size of the individual fish is also a factor in survival, with large-bodied fish more susceptible to damage, though they are also more able to find and hold in eddies and other slower moving waters in the stream. Irrigation flows are of lower magnitude than flood flows, and may provide more suitable habitat allowing for the survival of fish released from White Mountain Lake. However, irrigation flows are done at the time of year that trout are not able to survive the temperatures either in the lake or downstream in Silver Creek, reducing the opportunity for trout to reach the Little Colorado River during that period. We generally consider that more fragile fish such as the trouts are much less likely to survive flood flows during the trip to the Little Colorado River than more robust species such as channel catfish, although, two large (405 mm and 330 mm) brown trout were found in the Little Colorado River near Salt Camp in May 2006 and October 2009, respectively. Salt Camp is approximately two miles below Lower Atomizer Falls and six miles above the confluence with the Colorado River. These are the first brown trout captured in the Little Colorado River since 1995 and both captures were following high-water events in the drainage. These trout could have moved up-river from the Colorado; a carp taken in 2010 about half a mile below Blue Springs where fish are not normally found indicates that fish could move downstream from other portions of the Little Colorado drainage (carp are also known from above Chute Falls and this individual could have moved upstream). It is interesting that in the spring of 2010, the Navajo Nation washes were not flowing extensively, but flows from the mainstem Little Colorado including Chevelon Creek and Jacks Canyon were high and might have triggered upstream or downstream movement of carp.

With the above considerations in mind, connectivity regularly exists between White Mountain Lake, lower Silver Creek, and the Little Colorado River habitats of the humpback chub. One channel catfish was recorded in 2000 during one of 12 surveys of Silver Creek between 1991 and 2009 below White Mountain Lake. Other nonnative warmwater fish species including green sunfish, yellow bullhead, and carp were reliably found, indicating that Silver Creek does support

nonnative fish populations. The presence of largemouth bass in 1999, 2002, and 2007 indicates that fish can move from White Mountain Lake as there is a reproducing largemouth bass population there as well as the other warmwater nonnatives including channel catfish which is the species of concern for this sub-drainage. The above analysis indicates that it is unlikely for channel catfish from the stocking sties in this drainage to either reach the occupied humpback chub critical habitat in the Little Colorado River, or to be supporting extant populations of channel catfish in White Mountain Lake or sites on the Little Colorado River that may be the source of channel catfish in the critical habitat unit as documented by Stone et al. (2007) and these catfish did not move upstream into that location from the Colorado River. The stockings under the proposed action are unlikely to have adverse effects to the recovery value of the Little Colorado River critical habitat unit for those reasons.

### *Schoens Complex*

This complex contains seven stocking sites; six lakes and one stream all in the Show Low Creek sub-drainage of Silver Creek. The sites are all connected, with water from the upper six sites flowing eventually into the lowest site (Fools Hollow Lake), which spills to Show Low Creek. The stocking sites are proposed for both cold and warmwater species. The new species to the stocking lists are not new to the drainage; they are present in the lakes as self-sustaining populations from past illegal stocking actions. Populations of these species may become depressed and AGFD may determine it is necessary to augment the population; however, the species would continue to be present in the lake without the augmentation, and the action would have little effect on restoration of population levels as populations would be expected to recover on their own via natural recruitment only over a longer time period.

There are three factors to consider in determining the degree of connectivity and subsequent exposure to humpback chub and critical habitat:

1. Distance and surface water: Show Low Creek below Fools Hollow Lake is intermittent, with permanent water only from seepage below the dam. During spills from the lake, water moves downstream to Lone Pine Dam, which has a permanently open outlet, to Schoens Dam, a distance of 15 miles. Schoens Dam is operated as a flood-control and irrigation reservoir, and water releases are controlled by the elevation/depth of water in the pool. No water can be released at elevations below 5,740 feet (approximately 3,000 acre-feet or 35 feet deep). This is because the irrigation tower/headgate structure is located above this elevation. Once water levels are above 5,740 feet, water can be released for irrigation purposes during the April 15-September 15 irrigation season or for flood-control purposes. Water released from Schoens Dam continues down Show Low Creek to its confluence with Silver Creek and then to the Little Colorado River. The Little Colorado River is mostly perennial from the confluence with Silver Creek to Holbrook, and then is ephemeral to the confluence with Chevelon Creek.
2. Flood events: The Little Colorado River above Grand Falls is seasonally connected to the lower Little Colorado and Colorado rivers during spring runoff and large precipitation events. Flood releases from Schoens Dam are part of that seasonal connectivity during some years.

3. There is little restriction on stocked fish moving from the upper stocking sites in this complex to Fools Hollow Lake at the lower end. During spill events from the lake, fish can wash over the spillway and move downstream. Fish that are in the water column such as trout or centrarchids are more likely to be captured by surface currents and carried to the spillway than bottom-dwellers such as channel catfish. Some movement of channel catfish to Schoens Dam's water-storage pool is indicated by reports from fishermen using the area of occasional channel catfish being present before the water dries up. Water released from Schoens Dam has similar issues to that at Fools Hollow Lake; the outlet structure is not at the bottom of the dam, but is at least 25 feet above the lake floor at the location of the irrigation tower. Channel catfish may be less likely to be captured in the outflow since they are not likely in the water column.

With the above considerations in mind, connectivity regularly exists between the stocking sites and Schoens Dam, with a lesser amount of connectivity below the dam due to restrictions on water releases. When there are releases, connectivity likely extends via Silver Creek to the Little Colorado River. The particular situation with water releases from Schoens Dam may limit the opportunity for channel catfish to move past the dam and into Silver Creek and be available for transport down the Little Colorado River. However, the continued stocking of channel catfish into the Show Low Creek sub-drainage maintains the populations at higher levels than would be supported by natural reproduction in Scotts Reservoir, Show Low Lake, and Fools Hollow Lake; however, there is also active angling for the species occurring in those sites. As described above and for the White Mountains Complex, we do not anticipate effects to the recovery value of the Little Colorado River critical habitat unit.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to humpback chub populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near

Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect humpback chub. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The stocking sites and their connecting watersheds are on the Coconino (Canyon Diablo) and Sitgreaves (Schoens and White Mountain) National Forests, with private and state lands along the lower portions of the tributaries and the LCR mainstem. The LCR also passes through the Navajo Nation and onto Grand Canyon National Park, where the critical habitat section is located.

Non-Federal actions in the Little Colorado River drainage are extensive; however, these effects have thus far not had a detectable adverse affect on humpback chub and its critical habitat in the Little Colorado River, perhaps because these affects are diffuse over a wide area, and are distant from humpback chub and its critical habitat. A recently completed management plan for the Little Colorado River watershed (Valdez and Thomas 2009) provides many thorough recommendations to conserve humpback chub in light of these potential effects.

## CONCLUSION

After reviewing the current status of humpback chub and its designated critical habitat in the Colorado River and Little Colorado River, the environmental baseline for the action area, the effects of the proposed sportfish stockings and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the humpback chub, and is not likely to destroy or adversely modify designated critical habitat.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

We present this conclusion on the humpback chub and its critical habitat for the following reasons:

- For the Havasu Creek stocking sites, we believe it is unlikely that any individuals of the stocked species, particularly channel catfish, could access the humpback chub habitats alive after being transported by flood waters. The spill potential from the stocking sites, the distances involved, and the physical conditions encountered, when considered together, leads to a very low risk of exposure of humpback chub to these fish. This low potential for exposure also leads to our determination that PBFs B2 and B3 would not be affected to the extent that the conservation value of the Colorado River Marble and Grand Canyon critical habitat reach would be diminished.
- For the Canyon Diablo stocking sites, we believe it is unlikely that any individuals of the stocked species, particularly channel catfish, could access the humpback chub habitats alive after being transported by flood waters. The spill potential from the stocking sites, the distances involved, and the physical conditions encountered, when considered together, leads to a very low risk of exposure of humpback chub to these fish.
- For the White Mountain stocking sites we believe it is possible that individuals of the stocked species, particularly channel catfish, could access the humpback chub habitats alive after being transported by flood waters. There is connectivity between the Little Mormon Lake stocking site and the LCR through White Mountain Lake for channel catfish if reproduction occurs in Little Mormon Lake; the grate on the outflow would prevent stocked adult channel catfish from escaping but not juvenile catfish which would only be present if reproduction occurs at this site. Channel catfish maintain a reproducing population in White Mountain Lake, and any channel catfish exiting the lake to Silver Creek would most likely come from that population and not the stocking sites. Channel catfish are a significant predator on young humpback chub, and the connectivity from these stocking sites is directly into the area above Chute Falls where recent translocations of small humpback chub to extend the area of the population and improve survivorship were undertaken. The number of channel catfish in that reach of the Little Colorado River is not known; however, augmentation of those numbers is likely to be deleterious to the chub. We do not believe that stocking channel catfish into Little Mormon and Whipple lakes has any measurable effect on existing channel catfish populations in this drainage or in the Little Colorado River.
- For the Schoens stocking sites, we believe it is unlikely that any individuals of the stocked species, particularly channel catfish, could access humpback chub habitats after being transported by flood waters to the flood pool at Schoens Dam. The manner of release for water behind the dam does not facilitate passage of bottom-dwelling fish such as channel catfish downstream.
- For the Little Colorado River critical habitat reach, we understand that nonnative fishes, including channel catfish, entering the upper end of the critical habitat reach via LCR inflows are an identified concern for PBFs B2 and B3. Based on our analyses, we believe that the channel catfish associated with stocking events included in the proposed action have, at best, an extremely minor effect to recovery values in the Little Colorado River since their ability to reach the critical habitat is very limited. Also, as discussed above, stocked channel catfish or their progeny are not supporting the currently established

populations of that species in Lyman Lake, lower Chevelon Creek, and Clear Creek Reservoir or washes draining into the Little Colorado River from the north. It is far more likely that individuals from those self-sustaining populations would access the Little Colorado River below Grand Falls as foreseen by Stone et al. (2007). While we agree that allowing channel catfish to reach the critical habitat unit is an adverse action that may adversely affect the recovery value of the unit, we are unable to determine that the stocking events covered in this consultation have any meaningful role in affecting humpback chub recovery in the Little Colorado River critical habitat unit.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- While there are humpback chub at and upstream from the confluence of Havasu Creek with the Colorado River, and in the LCR below Grand Falls, we cannot be reasonably certain that any stocked fish or its progeny from any of the stocking sites would reach occupied humpback chub habitat for the reasons discussed above. Our interpretation of distance, connectivity, and the likelihood of survival for stocked sportfish or their progeny during transport by high flows to humpback chub habitat does not lead to the

reasonable certainty needed to determine that incidental take from the proposed action would occur. Thus, the first condition is not met. Further, there already are self-sustaining channel catfish in the LCR above Grand Falls and in the Colorado River downstream of Havasu Creek, and it is more likely that any channel catfish moving down into occupied humpback chub habitat on the LCR or found in the Colorado River is part of those populations. We cannot be reasonably certain that the proposed action would result in take, thus the second criteria is not met.

If, in the future, there is documentation that stocked fish or their progeny has reached occupied humpback chub habitats, we will reevaluate this determination.

### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We have not identified any conservation recommendations for the humpback chub.

### Little Colorado spinedace (*Lepidomeda vittata*) and critical habitat

#### DESCRIPTION OF THE PROPOSED ACTION

Little Colorado spinedace (spinedace) and its critical habitat may be affected by proposed stocking actions at sites in the stocking complexes as listed in Table 8. New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. Stocking sites within Table 8 complexes that were determined not to have potential adverse effects to spinedace are not listed in the table.

Table 8: Stocking sites, species proposed for stocking, and potentially affected Little Colorado spinedace populations and/or designated critical habitat.

| Stocking complex/site | Sportfish proposed for stocking | Spinedace population affected   | Spinedace critical habitat affected |
|-----------------------|---------------------------------|---------------------------------|-------------------------------------|
| <i>Chevelon Creek</i> |                                 |                                 |                                     |
| Chevelon Canyon Lake  | ONMY, THAR*                     | Lower Chevelon<br>West Chevelon | Chevelon Creek                      |
| Long Tom Tank         | ONMY                            | Lower Chevelon<br>West Chevelon | Chevelon Creek                      |
| Willow Springs Lake   | ONMY                            | Lower Chevelon<br>West Chevelon | Chevelon Creek                      |
| Woods Canyon Lake     | ONMY                            | Lower Chevelon<br>West Chevelon | Chevelon Creek                      |

|                                        |                                       |                                        |                                            |
|----------------------------------------|---------------------------------------|----------------------------------------|--------------------------------------------|
| <i>Clear Creek</i>                     |                                       |                                        |                                            |
| Bear Canyon                            | ONMY, SAFO                            | East Clear Creek                       | East Clear Creek below CC Cragin           |
| CC Cragin                              | ONMY                                  | East Clear Creek                       | East Clear Creek above and below CC Cragin |
| Knoll Lake                             | ONMY                                  | East Clear Creek                       | East Clear Creek below CC Cragin           |
| Clear Creek Reservoir                  | ONMY                                  | East Clear Creek                       | East Clear Creek below CC Cragin           |
| <i>Little Colorado above Lyman</i>     |                                       |                                        |                                            |
| Becker Lake                            | ONMY, ONAP, THAR*                     | Little Colorado River                  | None                                       |
| Hulsey Lake                            | ONMY                                  | Nutrios Creek                          | None                                       |
| Lyman Lake                             | ONMY                                  | Little Colorado River                  | None                                       |
| Nelson Reservoir                       | ONMY                                  | Nutrios Creek<br>Little Colorado River | Nutrios Creek                              |
| <i>Schoen's</i>                        |                                       |                                        |                                            |
| Fools Hollow Lake                      | ONMY, ONAP*, ONCL*, SAFO*, ICPU, LEMA | Silver Creek                           | None                                       |
| Rainbow Lake                           | ONMY, ICPU*, LEMA*, MISA*             | Silver Creek                           | None                                       |
| Mountain Meadow Recreational Complex*  | ONMY, LEMA                            | Silver Creek                           | None                                       |
| Scotts Reservoir                       | ONMY, ICPU, LEMA*                     | Silver Creek                           | None                                       |
| Show Low Creek*                        | ONMY                                  | Silver Creek                           | None                                       |
| Show Low Lake                          | ONMY, SAFO*, ONCL*, ONAP*, ICPU, LEMA | Silver Creek                           | None                                       |
| Woodland Lake                          | ONMY, ICPU, LEMA*                     | Silver Creek                           | None                                       |
| <i>West Fork Little Colorado River</i> |                                       |                                        |                                            |
| Bunch Reservoir                        | ONMY, ONAP*                           | Little Colorado River                  | None                                       |
| Lee Valley Lake                        | ONAP, THAR                            | Little Colorado River                  | None                                       |
| WF Little Colorado River at Greer      | ONMY, ONAP                            | Little Colorado River                  | None                                       |



|                                             |             |                       |      |
|---------------------------------------------|-------------|-----------------------|------|
| WF Little Colorado River at Sheeps Crossing | ONAP        | Little Colorado River | None |
| Mexican Hay Lake                            | ONAP        | Little Colorado River | None |
| River Reservoir                             | ONMY, ONAP* | Little Colorado River | None |
| Tunnel Reservoir                            | ONMY, ONAP* | Little Colorado River | None |
| White Mountain Reservoir                    | ONMY        | Little Colorado River | None |
| <i>White Mountain</i>                       |             |                       |      |
| Silver Creek                                | ONMY, ONAP  | Silver Creek          | None |
| Little Mormon Lake                          | ICPU        | Silver Creek          | None |
| Whipple Lake                                | ICPU        | Silver Creek          | None |

#### Conservation measures included in the proposed action

The stocking restrictions and implementing actions from the 1995 (USFWS 1995) and 2001 (USFWS 2001) incidental take statements for CC Cragin Reservoir, Knoll Lake, and Nelson Reservoir, except for modified creel requirements, are part of the proposed action for this consultation and will be implemented over the next 10 years as described in those documents. Creel will occur no less than once every ten years.

AGFD will, within three years, convert all rainbow trout stocking from its hatcheries to triploid individuals. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population of rainbow trout in the vicinity of any wild or reintroduced population of Little Colorado spinedace.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

While implementing the Integrated Fisheries Management Plan for the Little Colorado River (Young et al. 2001) and the East Clear Creek Watershed Recovery Strategy for Little Colorado Spinedace and Other Riparian Species (USDA 1999), in cooperation with other partners, AGFD will consider other conservation actions to benefit the species (non-mandatory measure). Such actions may include, but are not limited to:

- surveys in the Chevelon Creek watershed from the headwaters to Rock Art Ranch to identify nonnative species distribution and determine suitability of habitats for spinedace reintroductions;
- once suitable habitats are identified, plan and implement renovations and reintroductions of spinedace into the Chevelon Creek watershed;
- mechanically remove wild trout from drainages above CC Cragin Reservoir and green sunfish from below the reservoir;
- remove wild brown trout and nonnative warmwater fish species from the mainstem Little Colorado River above Lyman Lake;
- repatriate spinedace found in Nelson Reservoir to occupied habitat upstream;
- continue to work with partners to replicate populations, fund habitat improvements, and maintain or improve habitat for spinedace on Wildlife Management areas that support spinedace; and

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

The spinedace was first listed as a threatened species under the Endangered Species Preservation Act of 1966 (32 FR 2001), and was considered a Category 1 candidate in the Review of Vertebrate Wildlife for Listing as Endangered or Threatened Species in 1982 (47 FR 58454). The species was listed 1987 under the 1973 Endangered Species Act (Act) as threatened with critical habitat (52 FR 35034). A special rule under section 4(d) to allow for take of individual spinedace under a valid State permit was enacted in 1975 (40 FR 44415). This special rule regulates take of spinedace for educational purposes, scientific purposes, zoological exhibition, and other conservation purposes consistent with the Act through applicable state fish and wildlife conservation laws and regulations.

##### Critical habitat

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the

point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species' eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (USFWS and NMFS 1998b). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

For spinedace, the role of each critical habitat unit in recovery was not defined in the recovery plan. For this analysis, we shall assume that any significant effects to the PBFs of critical habitat could result in a loss of conservation value for that critical habitat unit.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the spinedace. This information was taken from the 1998 recovery plan (USFWS 1998b) and the most recent 5-year review (USFWS 2008e). Information in these documents is incorporated by reference.

#### *Life history*

Spinedace are omnivorous, and food items include chironomid larvae, other dipterans, filamentous green algae, and crustaceans (Runck and Blinn 1993, Blinn and Runck 1990). Spinedace are late-spring to early-summer spawners (Blinn et al. 1994, Blinn and Runck 1990, Miller 1961, Minckley 1973, Minckley and Carufel 1967) although some females have been found to contain mature eggs as late as October (Minckley and Carufel 1967). A complete discussion of the taxonomic, distributional, and life history information of the spinedace has been compiled in the Little Colorado Spinedace Recovery Plan (USFWS 1998b).

#### *Habitat use*

Available information indicates that suitable habitat for the spinedace is characterized by clear, flowing pools with slow to moderate currents, moderate depths, and gravel substrates (Miller 1963, Minckley and Carufel 1967). Cover provided by undercut banks or large rocks is often a feature. Spinedace have also been found in pools and flowing water conditions over a variety of substrates, with or without aquatic vegetation, in turbid and clear water (Denova and Abarca 1992, Nisselson and Blinn 1991). Water temperatures in occupied habitats ranged from 58 to 78 degrees Fahrenheit (Miller 1963). Both mountain streams and lower-gradient streams and rivers have provided habitat for the spinedace. Residual pools and spring areas are important refuges

during periods of normal low water or drought.

#### Current distribution

The spinedace historically occupied the Little Colorado River and its northward flowing tributaries off the Mogollon Rim and the White Mountains. Between 1939 and 1960, many spinedace populations were lost. Currently, spinedace is found in disjunct locations in the East Clear Creek watershed, Chevelon Creek, the upper Little Colorado River, and Silver Creek. Populations are small and undergo yearly fluctuations that make long-term assessment of population trends difficult to determine. Populations are known to be extant in all drainages listed above; however, no spinedace has been found in Silver Creek since 1997. Genetically, the spinedace populations in the first three drainages are separate sub-groups (genetic analysis on Silver Creek fish has not been done) and maintaining each group is important to conserve genetic variation.

In the East Clear Creek drainage, spinedace are found in small perennial pools in otherwise ephemeral drainages in West Leonard and Leonard Canyon (Dines Tank) with populations in Bear, Dane, and Yeager canyons supplemented from the West Leonard Canyon and Dines Tank. In the mainstem of East Clear Creek, spinedace are found above CC Cragin Reservoir in Bear Canyon. Populations of spinedace in this drainage have declined significantly since listing and currently are at particular risk from the continuing drought due to the small isolated pool habitats they occupy. Extensive efforts to salvage spinedace from drying pools and place them in more secure habitats has been done and likely will continue.

In the Chevelon drainage, spinedace are found in the lower eight miles of the creek above the confluence with the Little Colorado River. This is the most robust population of spinedace remaining throughout its current range. As a conservation action, spinedace was stocked into West Chevelon Creek, a tributary stream about 40 miles upstream of the occupied habitat in 2007.

In the Little Colorado River drainage, spinedace are found in the mainstem from Springerville to St. Johns, including on AGFD's Becker and Wenima Wildlife Areas, and in the reach above Lyman Lake. They are also found in Nutrioso Creek from the Apache-Sitgreaves National Forest boundary upstream to Nelson Reservoir and from the reservoir upstream to the town of Nutrioso and in Rudd Creek, a tributary to Nutrioso Creek. Spinedace are found in small to moderate numbers at these sites.

In the Silver Creek drainage, spinedace were found in 1997 in the lower portion of the creek above the confluence with the Little Colorado River. Silver Creek is mostly perennial in this reach. Repeated surveys have not documented their presence since that time.

The status of the spinedace is not secure and additional declines from ongoing threats are anticipated. Amelioration of these ongoing threats to an extent that populations can stabilize is unlikely in the short term. In our 5-year review (USFWS 2008e), we recommended that the spinedace be uplisted to endangered, as its current status indicates it is in danger of extinction throughout its range. Threats of particular concern identified in the 5-year review were

continuing ground and surface water development, drought, and the continuing effects of invasive aquatic species.

### Threats

Threats to the spinedace pose a significant challenge to the conservation of the species. Availability of habitats with permanent water in the drainages, particularly East Clear Creek and Chevelon drainages and below Nelson Reservoir is limited due to a variety of factors, including groundwater withdrawals, surface water diversions and dams controlling flows. The Chevelon Creek population is at significant risk of losing surface flow due to continued groundwater pumping in the C-aquifer. In East Clear Creek, spinedace relies on precipitation to support permanent aquatic habitats in the absence of springs and other groundwater sources to provide surface flows. Continuing drought has exacerbated water supply issues, requiring emergency salvage of spinedace from small habitats in danger of drying up. Spinedace populations are particularly at risk from drought as they are in small habitats with limited water supplies that are not well connected hydrologically to other populations. Reduced flows due to drought are also a problem for the Little Colorado/Nutrios Creek populations because of surface water diversions for agriculture and groundwater pumping for agricultural, commercial, industrial, and municipal purposes. There are no extant management actions that could provide protection for spinedace habitats from groundwater withdrawals.

The widely scattered and isolated nature of spinedace populations also put it at risk from wildfire on the watershed. Burn-over could be devastating in the small watersheds that support the species, with subsequent ash flows that put toxic materials into streams that can move for many miles downstream. Use of fire retardant compounds is also of concern as some of these can be toxic to aquatic life. The 2011 Wallow Fire burned in the Little Colorado River watershed above the populations in the mainstem Little Colorado River near Springerville and in Nutrios and Rudd creeks. Spinedace were salvaged from these streams prior to post-fire runoff events that could result in toxic conditions in the streams; however the status of these populations is not known at this time. For the purposes of this BCO, we assume all populations of spinedace are extant.

The presence of nonnative fish species, both coldwater and warmwater species, and crayfish in spinedace habitats have negative effects on spinedace populations. The presence of nonnative species was a primary reason for listing the species, and the effects of these species on spinedace through competition and predation varies. Some, such as channel catfish, green sunfish, largemouth bass, brown trout, and rainbow trout are likely predators, with fathead minnows, golden shiners, and rainbow trout also competing for food and space. Golden shiners were particularly mentioned as a problem in Chevelon Creek. Crayfish may prey on and compete with spinedace, plus, their activities alter physical habitat conditions through removal of vegetation and burrowing in the substrate. The recent illegal stockings of largemouth bass, smallmouth bass, green sunfish, yellow bullhead, and yellow perch into headwater lakes in East Clear and Chevelon Creek drainages has added another layer of predators and competitors to the existing degraded condition of the biological environment.

An example of how the combination of changes in habitat can also influence the success of

nonnative species introduced into spinedace habitat is the current conditions in Silver Creek. In 1997, the habitat at Silver Creek was typical of spinedace habitat; shallow riffle/run areas with occasional small pools. Beginning in 1999, the habitat began to shift to deep pools due to the influx of beavers and their dam construction activities. This type of habitat is still suitable for spinedace; however, surveys for the species are more difficult in this type of habitat and it is more suitable for nonnative fish species. Surveys in 2004 (McKell and Lopez 2005) documented fathead minnows, green sunfish, and common carp as the dominant species present. There are previous records of largemouth bass and channel catfish in this reach. Other native fish species formerly captured in this reach are also in reduced numbers. While we believe this habitat is still occupied by spinedace, the value of this area for conservation has declined significantly and it may not be recoverable.

### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the (species) recovery plan. To assist in the conservation of the spinedace, several actions and programs have been developed and are being implemented. These include (summarized from USFWS 2008e):

- Refuge and conservation populations for the three identified lineages have been developed. Refuge populations for two of the three lineages exist in the Arboretum at Flagstaff (East Clear Creek) and the Grasslands Wildlife Area (Little Colorado River). A refuge for the Chevelon population is under development at Winslow High School.
- Supplemental stocking into Bear, Dane, and Yeager canyons in the East Clear Creek drainage to expand population sites has been accomplished, other movement of spinedace from drying pools to what are hoped is more secure pools was done, and a new population was created in West Chevelon Creek through translocation in 2007.
- The East Clear Creek Watershed Recovery Strategy for spinedace and other riparian species identified activities to assist in recovery of spinedace and its habitats in the drainage. Improved livestock management, protection for headwater meadows, and other actions to protect and improve spinedace habitats have been completed and others will be implemented. Wildland Urban Interface (WUI) projects in East Clear Creek and Nutrioso Creek drainages assist in watershed rehabilitation and reduction in wildfire risks.
- AGFD has secured land and water rights in their Wildlife Areas (Becker, Chevelon, Grasslands, Sipes, and Wenima) that provide stream flows and refuge areas for the spinedace.
- Funding from a variety of sources has allowed for riparian restoration efforts along a portion of Nutrioso Creek occupied by spinedace. Additionally, a Safe Harbor Agreement on the EC Bar Ranch has provided some longer term management for this reach of occupied habitat.
- Research on genetic variation between spinedace populations has provided insights on management needs to maintain the extant lineages. Additional research on spinedace life history and habitat requirements, spinedace/trout interactions, and effects to spinedace of crayfish have assisted in defining threats and identifying suitable habitats for translocation and future nonnative management actions.

*Critical habitat*

Critical habitat for the spinedace was designated in 1987 (USFWS 1987a). Areas designated as critical habitat were in the East Clear Creek drainage (East Clear Creek from its confluence with Leonard Canyon upstream 15 miles to CC Cragin Reservoir and from the upper limit of the reservoir upstream 13 miles to Potato Lake), Chevelon Creek (from the confluence with the Little Colorado River upstream eight miles to Bell Cow Canyon), and in the Little Colorado drainage (Nutrioso Creek from the Apache-Sitgreaves National Forest boundary upstream five miles to Nelson Reservoir dam). While there is a recovery plan for the spinedace (USFWS 1998b), the standards for recovery plans in effect at that time did not require identification of the recovery values for critical habitat units. For the purposes of this BCO, we shall consider the recovery value of any critical habitat unit to be compromised if the proposed action results in significant changes to any PBF.

The critical habitat designation described the constituent elements to include clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate and that these were considered essential for the conservation of the species. The designation discussed the types of activities that could adversely modify critical habitat, focusing on activities that would deplete, lessen, or alter the natural hydrograph of stream flows, extensively alter the channel morphology, or extensively alter the water chemistry. There is no discussion of the presence of nonnative species as a concern for the biological feature of critical habitat in the designation; this is a result of differing standards in place during the period when the spinedace was listed and critical habitat designated. The physical and biological factors (PBFs) were considered as being present at the time of designation. All critical habitat units are essential for the conservation of the species.

At the time of designation, three critical habitat units had extant issues dealing with natural streamflows from existing dams upstream of three of the four units (one East Clear Creek unit is upstream of CC Cragin Reservoir). Those conditions continue to exist, with threats to streamflows increasing due to groundwater pumping at the Chevelon Creek unit and drought at the lower East Clear Creek and Nutrioso units that affect releases from the dams into the critical habitat reaches. The continuing diversion of water from CC Cragin Reservoir to the East Verde River also affects natural flow patterns below that dam as less water is retained in the reservoir to spill downstream. Drought has affected the flows in all critical habitat units and this may continue into the future depending on weather patterns.

Channel morphology can be adversely affected by watershed conditions, such that surface flows off a degraded watershed are altered in the speed at which runoff occurs, the length of time that runoff occurs, and the amount of sediments transported in the runoff. The conditions of riparian buffers along the streamcourse are also a factor in how surface runoff reaches the stream channel and the subsequent erosion or sediment deposition that occurs. We do not have any information about changes to this PBF since designation. Effects to this PBF from runoff following the Wallow Fire may have occurred below Nelson Reservoir if flows overtopped the dam and continued downstream; however, we do not have specific information at this time as to the extent of damage that has already occurred.

Water quality issues related to chemical and biological pollutants were third component. The types of these “pollutants” were not specified. Degraded watershed conditions can lead to excessive sedimentation, wildfires can also lead to higher sedimentation rates and toxic ash flows that can eliminate an spinedace population and temporarily degrade this PBF. Improper management of livestock or elk grazing where the small habitats are overused and fecal matter builds up in the stream that degrades water quality may also be an issue. Section 7 consultations on watershed health, livestock management proposals and Wildland Urban Interface (WUI) fuels management projects have identified measures to reduce the risks of these water quality risks.

Although there is no biological environment PBF concerning the presence of nonnative species in spinedace critical habitat, the presence of these species does have effects to the PBF and how the spinedace is able to use habitat containing the PBFs. For example, crayfish remove submerged vegetation that can act as cover for fishes, consume large amounts of the aquatic insect food base, and, through their burrowing, increase bank instability that leads to excessive sedimentation (Fernandez and Rosen 1996). Research has shown (Bryan et al. 2002) that the presence of crayfish in spinedace habitats causes the spinedace to alter their behavior and use of habitats. Rainbow trout also have this effect, and it is magnified when both nonnative species are present. The effect of native and nonnative trouts on spinedace is also discussed in Blinn et al. (1993), Bryan et al. (2002) and Sweetser et al. (2002). Interactions between rainbow trout and spinedace are prominent in these papers.

#### *Previous consultations*

Section 7 consultations on spinedace include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, wildfire suppression, recreation, and other issues), and more site-specific efforts that are more focused on implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting spinedace may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

The movement of stocked sportfish from the stocking sites listed in Table 8 has the potential to affect all four population areas for spinedace, so the action area is the rangewide distribution.

#### **A. Status of the species and critical habitat within the action area**



Because the action area is the range of the species, the status of the species is the same as previously discussed.

### **B. Factors affecting the species' environment and critical habitat within the action area**

The current status of the species is the aggregate of past land management actions that have affected habitat conditions, introduction of nonnative aquatic species that compete with or prey on spinedace, and the ongoing drought in the southwestern United States.

#### **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the spinedace are in the final rule (USFWS 1987a), the recovery plan (USFWS 1998b), and the 5-year review (USFWS 2008e). These documents are incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition and hybridization by the stocked sportfish species on spinedace.

As described in the interactions document in Appendix D, stocked rainbow trout do not persist long in the stream after the stocking event due to a number of factors including natural mortality events, angler catch, and predation by other species (such as brown trout or smallmouth bass) on the stocked trout. The repeated stockings are necessary to maintain a fishable population under these conditions. Stocked rainbow trout can and do convert to eating natural foods if they live long enough to do so, and can be predators on small fish at that time. The number of times that potential predation event can be realized is difficult to determine since for the event to occur, the individual stocked rainbow trout must survive long enough to convert to natural feeding and access the occupied habitat of the native fish. Over a 10-year period, this may occur, but we do not expect it to be a common occurrence as described below.

#### *Chevelon Creek*

The stocking sites in this complex have been stocked with rainbow trout for many years. The only new species is Arctic grayling in Chevelon Canyon Lake. Past stocking effects are in the environmental baseline.

The four Chevelon Creek stocking sites are hydrologically connected, with Chevelon Canyon

Lake the lowest site in the drainage. Any water releases from Long Tom Tank, Willow Springs, or Woods Canyon Lake enter Chevelon Canyon Lake, which does spill in the spring following runoff events that fill the system. The reach of Chevelon Creek below the lakes does not maintain perennial flows following spring runoff; however, there are isolated pools that can persist through the summer and may be augmented by summer monsoon flows in the tributary watersheds. Rainbow trout are stocked in all four lakes, with Arctic grayling also stocked in Chevelon Canyon Lake. Rainbow trout and Arctic grayling can persist year-round in Chevelon Canyon Lake but do not reproduce in the lake; however there may be some reproduction of rainbow trout in the perennial reach of Chevelon Creek between Willow Springs/Woods Canyon lakes and Chevelon Canyon Lake. The stocking of triploid rainbow trout will essentially eliminate the ability of stocked rainbow trout to support any wild population above the lake.

Rainbow trout have been documented below Chevelon Canyon Lake five times in surveys spanning 1965 through 1991. Surveys below the dam and at two sites above the West Chevelon Creek confluence (10.5 miles below the dam) in 2005-2008 have not documented any rainbow trout; however, these surveys were done in August and September which may be too late in the year to detect rainbow trout due to temperatures in the isolated pools exceeding their thermal tolerance. Arctic grayling have a lower thermal tolerance than rainbow trout, and are less likely to persist. Rainbow trout have never been detected in the occupied spinedace habitat in the lower eight miles of Chevelon Creek, and if they did reach there, would not persist over the summer due to high temperatures. Direct effects to the spinedace population in lower Chevelon Creek are not anticipated to occur from stocking sportfish into the sites in this complex.

Spinedace were reintroduced into West Chevelon Creek in 2007, and surveys since then have documented the species present through May, 2009. Spring runoff flows can displace spinedace from the secure habitats in West Chevelon downstream into Chevelon Creek. The lower 16.2 miles of West Chevelon Creek are dry except during runoff events, and any spinedace washed out of this creek are likely unable to move back upstream. If these spinedace find one of the permanent pools in Chevelon Creek, they may persist there if water quality remains suitable; although it is not certain if they could establish themselves here. The historical range of the spinedace in Chevelon Creek is unknown, and the population in lower Chevelon was only documented in 1977 and none had been found in the watershed previously. Golden shiners were abundant in the upper reaches of Chevelon Creek (Minckley and Carufel 1967), and attempts to eliminate them in the 1960s (they had been present since the 1950s) with toxicants likely also removed individuals of native species, including spinedace as well. Golden shiners are identified as an immediate threat to spinedace (Minckley and Carufel 1967).

The physical habitat may remain suitable for spinedace in this reach of Chevelon Creek, but existing populations of nonnative fish may reduce the potential for re-establishment. Species present in the pools below Chevelon Canyon Dam are a mix of nonnative (fathead minnow, golden shiner, and a few brown trout) and native (speckled dace, Little Colorado sucker, bluehead sucker, and roundtail chub) fish species that may interact with spinedace in various ways, including competition for food and space by fathead minnow and golden shiner, and potential predation in the case of brown trout and roundtail chub. The addition of rainbow trout to these pool populations adds another potential predator for at least part of the year, and no establishment of this species is likely due to temperature conditions and the stocking of triploid

individuals. Small Arctic grayling are generally not piscivorous, but could compete for food and space with spinedace during the period they are present.

Effects to the critical habitat reach in lower Chevelon Creek are not expected to occur from the proposed action as the stocked trout species are unlikely to reach the critical habitat unit, and unlikely to persist for even a short time there due to high temperatures.

*Clear Creek (including Clear Creek Reservoir)*

The stocking sites in this complex have been stocked with rainbow trout and Arctic grayling for many years. Past stocking effects are in the environmental baseline. This complex contains three stocking sites in the headwater areas of East Clear Creek (Bear Canyon Lake, CC Cragin Reservoir, and Knoll Lake) and one site near the confluence with the Little Colorado River (Clear Creek Reservoir). Rainbow trout are proposed for stocking in all sites, with Arctic grayling also proposed for Bear Canyon Lake. Neither species reproduces in any of the lakes, but can carry over to the next stocking season in the three high elevation sites. The stocking of triploid rainbow trout will essentially eliminate the ability of stocked rainbow trout that could leave the stocking sites from supporting any wild rainbow trout populations in the drainage.

Bear Canyon Lake is located on an ephemeral tributary of Willow Creek, which joins East Clear Creek approximately one mile above Hamilton Crossing. Bear Canyon Lake fills and spills from spring runoff every year; no other water is released downstream from the lake. Bear Canyon below the lake may hold some isolated pools outside of the runoff season. Willow Creek is not perennial, flowing to East Clear Creek only during the spring runoff but it does have some permanent water between Gentry Creek and Cabin Draw in the form of large, deep pools. Trout or grayling that exit Bear Canyon Lake during spring runoff may be able to persist in the deep pools through the summer. One rainbow trout was found immediately below the dam, but none were found in surveys in 1999, 2000, or 2004-2005.

Spinedace were known in East Clear Creek down to at least Macks Crossing, at least five miles upstream of the confluence of Willow Creek and East Clear Creek. Except for a single fish located in a pool below the dam in 2005, they have not been documented in East Clear Creek below CC Cragin since 1997 despite nearly annual surveys at five locations. Effects to spinedace are unlikely due to the current status of the species downstream of the lake.

CC Cragin Reservoir is on the headwaters of East Clear Creek with spring runoff from several small streams the primary source of water. The headwater streams are intermittent, with some permanent water upstream of the lake that outside of spring runoff, is not connected to the lake. Baseflows in East Clear Creek immediately below the dam are supported by seepage from the dam and water released from a two-inch pipe, and the reservoir can spill in the spring during high water years. Flows below the dam are perennial to the confluence with Leonard Canyon. Beginning in 2012, the reservoir may spill less frequently due to resumption of trans-basin diversions of water from the reservoir to the East Verde River.

Rainbow trout stocking into CC Cragin is covered under a 1995 biological opinion and its 2001 update (USFWS 1995a, 2001c). This BCO will cover stocking at CC Cragin Reservoir for the

next 10 years, replacing the existing consultations. The stocking provisions in the 1995 BO were modified in 2001 and are carried through to the present for this consultation:

- Stock to maintain put-and-take rainbow trout fishery.
- All stocked fish to be tagged with coded wire tags or tetracycline.
- Stocking to begin each year as soon as practical following spring runoff and outflow from the reservoir ceases.
- Cease stocking if/when habitat conditions (temperature, pH) deteriorate but prior to Labor Day.
- Initial stocking rate to be 15,000 catchable rainbow trout per year, but adjusted to accommodate angler use, fish survival, and water conditions.

Monitoring was also implemented:

- Creel census to be stratified random, 2 weekdays, 2 weekend/holiday per month during the period of April to September at least once every 10 years.
- Following significant stocking season runoff events resulting in spills sufficient to move fish, population surveys upstream and downstream from the reservoir, conducted during the low flow periods of May to June and September to October, are needed to detect movement of tagged fish should they migrate from the reservoir.

Additionally, harvest limits on rainbow trout from April 1 to August 31 is six trout, with unlimited harvest of rainbow and brown trout from September 1 through March 31. The unlimited harvest is to reduce the number of trout in the reservoir prior to the spring runoff period when trout could escape the reservoir into the spinedace habitat downstream. Also, during spring runoff, trout could move upstream into occupied spinedace habitat in East Clear Creek and Bear Canyon. One stocked rainbow trout was found below the reservoir in 2005. No stocked rainbow trout have been detected above the reservoir during surveys from 2003 through 2009. Wild rainbow trout populations are present above and below the reservoir.

Spinedace is present in Bear Canyon above the reservoir and in Dane Canyon, Yeager Canyon, and West Leonard Canyon which join East Clear Creek below the reservoir. Spinedace populations in East Clear Creek below the reservoir have declined significantly from the 1990s to the present. Until one spinedace was found below the dam in 2005, the last spinedace documented was in 1997 at the station a mile above the 95 Road Crossing (very near the base of the dam). The origin of this spinedace is unknown; however, it could have come from East Clear Creek or its tributary below the reservoir or upstream of the reservoir.

The reason for the decline of spinedace in the East Clear Creek drainage is not certain, however, long term droughts that reduce available habitats and large populations of nonnative species such as crayfish and fathead minnows in East Clear Creek below the reservoir are likely important factors. Above the lake, drought has required salvage and movement of spinedace populations from imperiled waters but the species is still documented there, in part because of active management efforts to move fish from drying pools. If trout were to access spinedace habitats, there could be predation and competition as described previously.

Critical habitat for spinedace exists in East Clear Creek above and below CC Cragin Reservoir.

As discussed previously, there was no PBF identified for critical habitat that identified nonnative fish as a concern. The 1995 biological opinion stated that stocking into CC Cragin Reservoir was reversible because the trout did not reproduce and thus did not appreciably reduce the value of critical habitat for conservation of the species. If rainbow trout were to access critical habitat, their presence may result in spinedace moving from more optimal to sub-optimal habitats. Research has shown that spinedace is preyed on by rainbow trout (Blinn et al. 1993) and that effects of rainbow trout in combination with crayfish were greater than with trout alone (Bryan et al. 2002). While there is no PBF for the presence of nonnative species such as rainbow trout, research has indicated that rainbow trout are competitors and predators on spinedace and their presence in the critical habitat reduces the recovery value of the unit. The use of triploid rainbow trout as part of the proposed action reduces the opportunity for any rainbow trout leaving the reservoir to supplement the existing wild trout populations through increased reproduction. The current management protocol for the reservoir that does not allow for stocking to occur until the reservoir has stopped spilling and contains monitoring to detect any stocked rainbow trout that leaves the lake, significantly reduces the opportunity for stocked rainbow trout to access spinedace critical habitat and have any significant impact on the recovery value of the unit through predation on or displacement of spinedace.

Knoll Lake is on East Leonard Canyon, a headwater tributary of Leonard Canyon. During spring runoff, Knoll Lake can spill, but the stream below becomes intermittent during the summer. Rainbow trout stocking into the lake is covered by the same consultation as CC Cragin and subject to the same restrictions.

Spinedace are found in small, perennial pools in West Leonard Canyon and at Dines Tank in Leonard Canyon. The Dines Tank population is below the confluence with East Leonard Canyon, so is downstream of Knoll Lake. To date, no stocked rainbow trout have been found below Knoll Lake during post-spilling surveys or other surveys in Dines Tank or West Leonard Canyon.

Clear Creek Reservoir is located at the bottom of the drainage immediately upstream of the confluence with the Little Colorado River. This area is 63 miles below known spinedace habitat and designated critical habitat. Spinedace from Barbershop Creek and Leonard Canyon may move down those drainages to Clear Creek and to the reservoir where they could encounter rainbow trout stocked from April to June. The distances involved and the lack of persistence of rainbow trout in the lake due to high temperatures reduces the opportunity for interactions.

#### *Little Colorado River above Lyman Lake*

The stocking sites in this complex have been stocked with rainbow trout and Apache trout for many years. Arctic grayling is a new species for Becker Lake. Past stocking effects are in the environmental baseline. This complex contains three stocking sites of concern (the others are closed systems); Hulsey Lake, Lyman Lake, and Nelson Reservoir. Rainbow trout is the only species proposed for these sites.

Trout and Arctic grayling stocked into Becker Lake do not reproduce in the lake and there is a grate on the outlet to prevent fish from leaving the lake. Effects to spinedace are not expected.

Hulsey Lake is a small (five acre) lake that spills regularly in the spring following snowmelt. It is subject to summer- and winter kill events that reduce or eliminate the population of stocked trout. Trout do not reproduce in the lake, and populations are maintained by stocking. Approximately 10,000 rainbow trout are stocked between April and July. Due to physical conditions around the lake, stocking generally does not occur until the spring spill is almost over with only a few inches of water going over the dam. Catchable sized rainbow trout could exit the lake during this period as they are in the midwater of the lake, but only a very few might since the outflow is shallow and currents leading to the dam lower than during the primary spill period.

Hulsey Lake is on Hulsey Creek, a tributary of Milk Creek which flows into Nutrioso Creek above the town of Nutrioso. Nutrioso Creek is perennial through the town, particularly during the season when Hulsey Lake would be spilling. Lower Hulsey Creek is intermittent may support some pools outside of the spring spill period and is considered fishless. Milk Creek is perennial, but surveys have not documented any fish in that stream. Survey records indicate five hatchery rainbow trout found below the town of Nutrioso and all were trout stocked into Nelson Reservoir (all trout there are marked). If a trout that had overwintered did escape the lake and access Nutrioso Creek, it would be in occupied habitat for spinedace. Any trout that had overwintered would be experienced at foraging for natural foods and could prey on or compete with spinedace.

The occupied spinedace habitat in Nutrioso Creek downstream of Hulsey Creek was affected by the Wallow Fire and the population status is unknown. Any fish kills in the river would have removed nonnative species as well as native ones, and the recovery of native fish populations (through surviving individuals or repatriations made with salvaged individuals) will be influenced by the recovery of the nonnative predatory species. Within three years, all rainbow trout stocked into Hulsey Creek will be triploid and establishment of a population is unlikely. The continued stocking into Hulsey Creek is unlikely to inhibit spinedace recovery in Nutrioso Creek since few fish are able to leave the system, and while those that do could persist, they cannot establish a reproducing population. The recovery of the nonnative predatory species is more likely to inhibit future spinedace recovery in this stream than stocked rainbow trout.

Lyman Lake is a large reservoir upstream of St. Johns that was constructed for irrigation water storage. Lyman Lake does not often fill, so it seldom spills; however, water is released below the dam for irrigation purposes downstream. The Little Colorado River upstream of the lake is perennial, with flows downstream dependent on irrigation releases into the river channel during the irrigation season (April 15-September 15) from the dam to St. Johns where the water is diverted for agricultural use. There is a limited amount of permanent water upstream of St. Johns, but the river below is often dry. Future flows in this area may be altered due to water deliveries to Zuni Tribal Lands downstream at and below Zion Reservoir.

Rainbow trout were last stocked into Lyman Lake in 1996. Conditions since then have not been favorable for rainbow trout due to the high turbidity of the lake resulting from carp feeding on the lake bottom. The proposed action would only occur in years when water quality and lake conditions are favorable for rainbow trout stocking. If stocking did occur, it could occur at any

time of the year.

There are no barriers upstream of Lyman Lake that would prevent rainbow trout from moving out of the lake. Downstream, rainbow trout could be released with spring spills or irrigation season releases. Rainbow trout records in the Little Colorado River above Lyman Lake are pre-1996 and are limited to two fish captured 14 miles upstream near Wenima in occupied spinedace habitat. These fish could have come from nearby Becker Lake or other sources. No rainbow trout have been documented below Lyman Lake.

If rainbow trout are stocked into Lyman Lake and move upstream out of the lake, they can move into occupied spinedace habitat. Predation and competition may result from this exposure but it is likely to be minimal due to the low numbers of trout expected to leave the lake and reach occupied spinedace habitat. The temperature conditions in the Little Colorado River above Lyman Lake are not conducive to support rainbow trout, and few have ever been documented in this portion of the river. The stocking of triploid rainbow trout will essentially eliminate the ability of stocked rainbow trout to support any wild population of rainbow trout above the lake, and if there is a self-sustaining population it is very limited in extent. Due to the distance involved and the warm waters between Lyman Lake and the critical habitat boundary, It is unlikely that any rainbow trout could reach the critical habitat unit below Nelson Reservoir and persist long enough to have any effect to PBFs or nonnative fish populations there.

Nelson Reservoir is located between occupied spinedace habitat areas up and down stream of the lake, and designated critical habitat is downstream of the lake. Nelson Reservoir spills in good runoff years, and, because water is not released from the dam for downstream uses, water levels may remain high enough for spills in moderate runoff years. There is some seepage from the dam that supports flows in Nutrioso Creek downstream to the confluence with the Little Colorado River that supports the PBFs of critical habitat in this unit. Nelson Reservoir was not directly affected by the Wallow Fire; however, runoff flows from upstream burned areas may have made their way through the lake to occupied spinedace habitats below.

Stocking at Nelson Reservoir is managed under the terms of a 1995 section 7 biological opinion as modified in 2001 (USFWS 2001c) as described below. This BCO will cover stocking at Nelson Reservoir for the next 10 years, replacing the existing consultations.

Modifications dictated by the consultation included the following:

1. Adjust stocking schedule as necessary to avoid stocking until water level is below the spillway and expected to remain so until the end of the stocking season. Unexpected spills may interrupt prescheduled stockings.
2. Stock only hatchery-reared catchable size rainbow trout that have been tagged with coded wire tags.
3. Stock trout to coincide with the summer fishing season, the approximate period being Memorial Day to Labor Day.
4. Conduct stream surveys, upstream and downstream of the reservoir, to determine whether tagged rainbow trout are moving to the connecting stream. If tagged trout are collected from areas occupied by spinedace, stomachs are to be taken and attempts made to

determine if spinedace are being consumed by the tagged trout. Surveys of the reservoir fish population, to determine survival and carryover of stocked trout, is encouraged.

5. Provide the Arizona Ecological Services Office with results of monitoring activities listed in number 4 annually.

Intensive monitoring conducted in Nutrioso Creek from 1996 through 2000 determined that these management modifications on Nelson Reservoir were working to greatly reduce potential impacts on Little Colorado spinedace (Novy et al. 2000; Sweetser et al. 2002). Few stocked trout had escaped the reservoir, and only during high spill events (Lopez et al. 2001; Sweetser et al. 2002), and stomach analysis of those trout found no fish remains (Robinson et al. 2000).

In 1998, a regulation change was made at Nelson Reservoir and Nutrioso Creek to attempt to further minimize adverse effects to Little Colorado spinedace resulting from the Nelson Reservoir stocking program. Unlimited rainbow and brown trout harvest was allowed from September 1 to May 1 in Nutrioso Creek from its confluence with the LCR upstream to Highway 180 in the Town of Nutrioso, including Nelson Reservoir. This regulation was developed to change the management direction from sport fish to native fish within designated critical habitat, and to encourage harvest of trout out of the reservoir just prior to the spring spill events, to minimize the chance of escape, and to remove trout from the creek if trout do escape.

Consultation was re-initiated in 2001 to consider the monitoring results on the effectiveness of the management modifications. This resulted in new management guidelines that were generally similar, but slightly modified, to those developed in 1995.

Stocking at Nelson Reservoir includes the following provisions (USFWS 2001c):

1. Stock to maintain put-and-take rainbow trout fishery providing 20,000 angler days annually.
2. All stocked fish to be tagged with coded wire tags or tetracycline.
3. Stocking to begin each year as soon as practical following spring runoff and outflow from reservoir ceases.
4. Cease stocking if/when habitat conditions (temperature, pH) deteriorate, but no later than Labor Day.
5. Initial stocking rate to be 20,000 catchable rainbow trout per year, but adjusted to accommodate angler use, fish survival, and water conditions.
6. Monitoring
  - a. Creel census to be stratified random, two weekdays, two weekend/holiday per month during the period April-September at least once every 10 years.
  - b. Following significant stocking season runoff events resulting in spills (sufficient to move fish), population surveys, upstream and downstream from the reservoir, conducted during low flow periods (May-June, September-October) to detect movement of tagged fish should they migrate from the reservoir.

Rainbow trout in Nelson Reservoir may overwinter but they do not reproduce. In addition to the five rainbow trout found upstream of the reservoir in 2000, 23 trout have been found below the reservoir, 22 of them in 2005-2009; years when spring spills were more frequent. Of the ones found below Nelson Reservoir, all but four were escapees from the reservoir (as documented by



tags), with five being overwintering individuals (based on size) that indicate they were used to feeding on natural foods and were capable of preying on spinedace. Stomach content analysis of these fish did not contain fish but did contain invertebrates that are also food for spinedace. A small population of wild rainbow trout (as evidenced by the capture of four small trout without tags) may exist somewhere in lower Nutrioso Creek; however these may be the progeny of wild trout from elsewhere, or escaped trout may have some opportunity for reproduction in the creek. The stocking of triploid rainbow trout will essentially eliminate the ability of stocked rainbow trout in Nelson Reservoir to support any wild population above or below the lake.

In surveys from 1988-2009, spinedace were almost always documented in Nutrioso Creek above the reservoir. They were not found below the reservoir from 2002-2008, but were found in 2009. Spinedace above and below Nelson Reservoir are at risk of predation or competition from rainbow trout stocked in the reservoir.

Critical habitat is designated in the reach of Nutrioso Creek below Nelson Reservoir. As discussed previously, there was no PBF identified for critical habitat that identified nonnative fish as a concern but rainbow trout is known to be a predator on and competitor with the species. The 1995 biological opinion stated that stocking into Nelson Reservoir was reversible because the trout did not reproduce to establish a population and thus did not appreciably reduce the value of critical habitat for recovery of the species. The number of rainbow trout accessing the critical habitat is very limited, and under the monitoring program, any trout found are removed, thus limiting the time of exposure. If rainbow trout were to access critical habitat, their presence may result in spinedace moving from more optimal to sub-optimal habitats and there is a risk of predation. Research has shown that spinedace do change their habitat use in the presence of rainbow trout as a predator and competitor (Blinn et al. 1993) and that effects of rainbow trout in combination with crayfish were greater than with trout alone (Bryan et al. 2002). While the PBFs are not affected by the presence of rainbow trout, the ability of the spinedace to effectively use the habitat is reduced. The current management protocol for the lake significantly reduces the opportunity for stocked rainbow trout to access spinedace critical habitat and any such occurrences are uncommon and do not contribute to a self-sustaining population of rainbow trout in the unit. Effects are temporary, and do not occur often and very few trout are likely to be involved over the term of this consultation. With this limited exposure, we believe that while there may be some temporary reduction in recovery value if rainbow trout were to reach this critical habitat, it does not have any significant effect on recovery value over the long term.

### *Schoen's Complex*

The stocking sites in this complex have been stocked with rainbow trout and channel catfish for many years. New species include Apache trout, brook trout, cutthroat trout, largemouth bass, and bluegill. Past stocking effects are in the environmental baseline. This complex contains seven stocking sites; six lakes and one stream all in the Show Low Creek sub-drainage of Silver Creek. The sites are all connected, with water from the upper six sites flowing eventually into the lowest site (Fools Hollow Lake), which spills to Show Low Creek. The stocking sites are proposed for both cold and warmwater species as described in Table 1.

Show Low Creek below Fools Hollow Lake is intermittent, with permanent water only from

seepage below the dam. During spills from the lake, water moves downstream to Lone Pine Dam, which has a permanently open outlet, to Schoens Dam, a distance of 15 miles. Schoens Dam is operated as a flood control and irrigation reservoir and water releases are controlled by the elevation/depth of water in the pool. No water can be released at elevations below 5,740 feet (approximately 3,000 acre-feet or 35 feet deep). This is because the irrigation tower/headgate structure is located above this elevation. Once water levels are above 5,740 feet, water can be released for irrigation purposes during the April 15-September 15 irrigation season or for flood control purposes. Water released from Schoen's Dam continues down Show Low Creek to its confluence with Silver Creek and then to the Little Colorado River. The spinedace habitat in Silver Creek is below the confluence of Show Low Creek with Silver Creek.

There is little restriction on stocked fish moving from the upper stocking sites in this complex to Fools Hollow Lake at the lower end. During spill events from the lake, fish can wash over the spillway and move downstream. Fish that are in the water column such as trout or centrarchids are more likely to be captured by surface currents and carried to the spillway than bottom-dwellers such as channel catfish. Some movement of channel catfish to Schoens Dam's water storage pool is indicated by reports from fishermen using the area of occasional channel catfish being present before the water dries up. Water released from Schoens Dam has similar issues to that at Fools Hollow Lake; the outlet structure is not at the bottom of the dam, but is at least 25 feet above the lake floor at the location of the irrigation tower. Mid-water species such as largemouth bass are more likely to be entrained into the outlet than bottom-dwellers such as channel catfish.

Due to the physical configuration of Schoen's Dam, sportfish in these stocking sites have a very limited opportunity to escape downstream to spinedace habitat. If any channel catfish or largemouth bass were to reach this habitat, they could persist in the perennial habitat and predation on spinedace could occur.

#### *West Fork Little Colorado River*

The stocking sites in this complex have been stocked with Apache trout, rainbow trout and Arctic grayling for many years. Apache trout are a new species for Bunch, River, and Tunnel reservoirs. Past stocking effects are in the environmental baseline. This complex contains eight stocking sites (two stream reaches and six lakes) proposed for stocking with combinations of Apache trout, Arctic grayling, and rainbow trout. The Little Colorado River is perennial from Greer to Springerville, a distance of approximately 18 miles to occupied spinedace habitat. Summer irrigation releases from Bunch, River, and Tunnel Lakes, and White Mountain Reservoir can transport trout in those lakes downstream as well as trout stocked into the mainstem at Greer or Sheeps Crossing. Trout in Lee Valley Lake could only escape when the lake spills, and, currently, no escapement from Mexican Hay Lake is anticipated since the outlet structure is inoperable. A series of small dams and diversions exists between Greer and occupied spinedace habitat, but none are a barrier to downstream movement of fish.

Dispersing trout in the Little Colorado River, most likely from River Reservoir, the other Greer Lakes, or from White Mountain Reservoir, in that order, could move further downstream into an 8.9 mile reach upstream of the Town of Springerville which is the upstream limit of occupied

spinedace habitat at Airport Road. Trout could persist here for some time, but likely not reproduce because it is marginally suitable for trout, especially rainbow trout or Apache trout.

From that reach, dispersing trout could further move downstream into an 8.5 mile reach of the LCR from Airport Road in Springerville to just below Wenima Wildlife Area, which is occupied habitat for Little Colorado spinedace. This reach is marginally suitable for brown trout, where large individuals are found but in very low numbers, but is not suitable for rainbow trout due to temperature. Only three rainbow trout have been documented in this reach through many years of surveys, two in 1993 and one in 1991. These trout may also have come from Becker Lake, as it was stocked with rainbow trout during this period and trout could leave the lake. This very rare occurrence record for rainbow trout indicates that they disperse into this area very infrequently, in very low numbers, and do not persist.

Wild brown and rainbow trout, speckled dace, bluehead sucker, Little Colorado sucker, fathead minnow, and crayfish occur in the 7.2 miles of the LCR downstream of River Reservoir. This stretch likely contains escaped rainbow trout as well, but is assimilated into an already wild population of rainbow trout.

Speckled dace, bluehead sucker, Little Colorado sucker, fathead minnow, crayfish, and consistent but low densities of brown trout and to a lesser extent rainbow trout, occur in the next 8.9 miles of the LCR to the upper end of Springerville.

Spinedace, speckled dace, bluehead sucker, Little Colorado sucker, fathead minnow, crayfish, green sunfish, and occasionally brown trout occur in the next 7.5 miles of the LCR from Airport Road in Springerville downstream to just below Wenima Wildlife Area. Rainbow trout occur in this reach extremely infrequently as noted previously.

Rainbow trout that move downstream could prey directly on adult or juvenile spinedace (Blinn et al. 1993) or compete for food and space. Blinn et al. (1993) and Robinson et al. (2000) reported changes in habitat use by spinedace when rainbow trout were present. Robinson et al. (2000) noted that there was little diet overlap between spinedace and larger trout, but noted that competition for food would likely occur between spinedace and trout of the same size. Adult Arctic grayling are potential predators of larval or juvenile spinedace. Apache trout evolved with spinedace; however, that does not mean that predation and competition did not occur between the two species.

The occupied spinedace habitat downstream of these stocking sites was affected by the Wallow Fire and the population status is unknown. Any fish kills in the river would have removed nonnative species as well as native ones, and the recovery of native fish populations (through surviving individuals or repatriations made with salvaged individuals) will be influenced by the recovery of the nonnative predatory species. Within three years, all rainbow trout stocked in this area will be triploid and establishment of a population is unlikely. Apache trout may be able to establish in the river through the stocking program, and may prey on recovering spinedace populations. Apache trout establishment would be limited to the upper and middle portions of the river, since water temperatures below Springerville are likely too warm for Apache trout persistence. Apache trout and spinedace likely co-existed at some level in some habitats within

their shared range, and the outcome of both species moving into the same habitats in the future is unknown. The recovery of other nonnative species such as brown trout may be a greater inhibiting factor in spinedace recovery than Apache trout.

### *White Mountain Complex*

The stocking sites in this complex have been stocked with Apache trout, rainbow trout and channel catfish for many years. Past stocking effects are in the environmental baseline. This complex contains five stocking sites; four lakes and one stream, of which only two are of concern since the others are closed systems. The Silver Creek site is connected to White Mountain Lake by perennial flows. Little Mormon Lake is on Rocky Arroyo, an ephemeral wash that flows in the spring and enters White Mountain Lake six miles downstream of Little Mormon Lake. Water in Little Mormon Lake is diverted from Rocky Arroyo for storage and later release to White Mountain Lake. White Mountain Lake is on Silver Creek and spills in the winter, with additional releases made during the irrigation season (April 15-September 15). Irrigation releases provide flows for approximately 18.6 miles downstream to the diversions near Taylor and Snowflake, and Silver Creek is mostly perennial for the last 22.5 miles to the confluence with the Little Colorado River. As described under the Schoen's complex, this portion of Silver Creek has undergone habitat modifications and the expansion of nonnative fish species.

White Mountain Lake contains reproducing populations of warmwater fish, including largemouth bass and channel catfish that can, during spills or irrigation releases, move out of the lake into Silver Creek. The trout species proposed for stocking in this complex (Apache trout and rainbow trout) are unlikely to move through the lake and have not been documented in lower Silver Creek. Stocked channel catfish in Little Mormon Lake cannot access White Mountain Lake because there is a grate on the outflow structure at Little Mormon Lake that would prevent adult channel catfish (the proposed action is to stock only adult channel catfish) from leaving the lake. If stocked channel catfish persisted and spawned, their progeny could move from the lake. The channel catfish in White Mountain Lake are naturally reproducing, thus it may be likely that they can reproduce in Little Mormon Lake, although Little Mormon Lake has virtually no spawning habitat for channel catfish, which prefer cover in which to lay and protect their eggs. Since channel catfish are already established at White Mountain Lake any contribution of escaped progeny if it were to happen would not be an important factor. At least one channel catfish has been documented downstream in Silver Creek (one in 2000), and its origin is unknown, but it may have come from the reproducing population in the lake or up from the mainstem Little Colorado River. If channel catfish were able to escape into Silver Creek, they would be able to persist in the perennial habitats and predation on spinedace could occur.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that

information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

Illegal introduction of nonnative fish species into the habitats of spinedace is continuing. The recent illegal stockings of largemouth bass, smallmouth bass, green sunfish, yellow bullheads and yellow perch into the East Clear and Chevelon upper watersheds is extremely detrimental to long term survival of the spinedace as it introduces additional predators and competitors to an already degraded biological habitat. The presence of these warmwater fish also may encourage the introduction of bait fish or waterdogs to the drainages, which may introduce new nonnative species or additional risks of transmission of diseases or parasites.

Disease and parasites are additional threats to spinedace populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect spinedace. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Stocking sites and affected habitats for spinedace is on a patchwork of lands depending on the particular drainage under consideration. Federal lands of the Apache-Sitgreaves and Coconino National Forests comprise the majority of the stocking sites and spinedace habitat areas in East Clear Creek and part of Nutrioso Creek, with state and private lands supporting the Chevelon Creek, part of Nutrioso Creek and most of the spinedace populations. On the Forest Service's lands, most activities that could potentially affect the spinedace are Federal activities and subject

to additional section 7 consultation. Water being transferred from CC Cragin Reservoir to the East Verde River is part of a Federal consultation related to Indian Water Rights. State lands, except for those managed by AGFD for wildlife purposes (State Wildlife Areas) are managed for their economic value as rangelands, forest lands, or may be sold for future development. We are not aware of any significant management change proposed for any state lands that could affect spinedace.

Private lands in the action area are used for agriculture, livestock production, forestlands, and residential/commercial/industrial development. Increasing development of private lands is also increasing the amount of groundwater used from the C-aquifer which underlies much of the action area and the lands to the north along the Little Colorado River. Continuing groundwater pumping is a particular risk to the Chevelon Creek population, with the springs that support the habitat perhaps failing in the next 50 years (USFWS 2008e). Water for the Silver Creek and Little Colorado River populations of spinedace is also not secure, as use may shift from agriculture to other purposes over the long term. However, we are not aware of any such specific projects at this time. The loss of water from the designated critical habitat, particularly at Chevelon Creek and Nutrioso Creek will adversely affect the PBFs and reduce or eliminate the value of the critical habitat for conservation of the species.

Use of live baitfish is illegal in the range of the spinedace, although use of waterdogs is allowed. Crayfish may be taken alive from any water to use as bait, but cannot be transported alive away from that water. The stocking of warmwater fish as part of the proposed action into the Schoen's and White Mountain complexes does create an illegal market for live baitfish for largemouth bass and channel catfish that may encourage illegal introduction of baitfish to sites where spinedace are present; however, these species are already widespread across the basin. The current distribution of golden shiner is a result of past legal and illegal baitfish use, introduction and movements.

## CONCLUSION

After reviewing the current status of spinedace and its critical habitat, the environmental baseline for the action area, the effects of the proposed fish stocking and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the spinedace and is not likely to destroy or adversely modify designated critical habitat.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

We present this conclusion on the spinedace for the following reasons:

- The overall status of the natural populations of spinedace is declining and likely will continue to decline over the 10-year period covered by this consultation. Loss of habitat from continuing water development combined with the ongoing drought is a significant threat to all populations, as is the increasing expansion of nonnative fish species in the

range of the spinedace. However, the proposed action in itself does not create an additional burden of adverse effects above and beyond what is already in the environmental baseline. This is because the three sites that are most likely to have adverse effects to spinedace (CC Cragin Reservoir, Knoll Lake, and Nelson Reservoir) already operate under restrictions in a 1995 biological opinion (as modified in 2001) that have significantly reduced the potential for adverse effects, and will continue to be operated under those restrictions with modified creel requirements under this BCO.

- Effects to spinedace from stocking in Chevelon Creek, Schoen's, West Fork Little Colorado River, and White Mountain complexes are very limited due to distance, connectivity with occupied spinedace habitat, and other physical conditions. Stocking actions for warmwater sportfish in these complexes do not add any new species to the drainage, and connectivity between the sites and occupied spinedace habitat is limited which reduces the opportunity for stocked sportfish to reach spinedace habitats.
- The proposed action includes the transition from normal rainbow trout to triploid rainbow trout over the next four to five years. These fish are bred to be sterile and unable to breed so any survivors that remain after the fishing season are not likely to establish or augment a reproducing population. This reduces the continuing potential for establishing rainbow trout in areas where they are currently not established.
- The critical habitat reaches above and below CC Cragin Reservoir and below Nelson Reservoir will, through continuation of the 2001 stocking restrictions, continue to maintain very low levels of degradation due to escaping rainbow trout from these reservoirs. This level of effect is low due to infrequency of occurrence, and that the events will not contribute to establishment or maintenance of wild rainbow trout populations in these critical habitat units. We believe that the recovery value of these critical habitat units is not compromised by stocking rainbow trout at these locations. Critical habitat in lower Chevelon Creek will not be affected by the proposed action.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is

defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by WSFR so that they become binding conditions of any grant or permit issued to AGFD, as appropriate, for the exemption in section 7(o)(2) to apply. WSFR has a continuing duty to regulate the activity covered by this incidental take statement. If WSFR (1) fails to assume and implement the terms and conditions or (2) fails to require the AGFD to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WSFR or AGFD must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Chevelon Creek, Schoen's, West Fork Little Colorado River, and White Mountain complexes: spinedace are not present in the stocking sites associated with these complexes, and spinedace are not likely to access any of these complexes. Thus, the first condition is not met. Stocked sportfish from these sites would have to leave the stocking sites and move downstream in order to potentially encounter any spinedace. This is most likely to happen in Chevelon Creek near the confluence with West Chevelon Creek, as spinedace are upstream in West Chevelon Creek and Chevelon Canyon Lake is known to spill regularly. However, the likelihood that both species would be found together as a result of these downstream movements is low. Further, there are other, more abundant, nonnative predators in Chevelon Creek that are more likely to encounter any spinedace moving out of West Chevelon Creek. Thus, the second condition is not met.

The AESO anticipates individual spinedace may be taken as a result of this proposed action at CC Cragin Reservoir, Knoll Lake, and Nelson Reservoir. The incidental take is expected to be in the form of harassment (competition for food and space) between spinedace and rainbow trout and harm (predation) from rainbow trout preying on small spinedace. The take will occur in the occupied habitat of spinedace in East Clear Creek and Nutrioso Creek when stocked rainbow



trout move out of the three stocking sites listed above.

The FWS anticipates incidental take of spinedace will be difficult to detect for the following reasons:

- The incidental take can only occur if stocked sportfish reach occupied spinedace habitat or spinedace move into the stocking site (Nelson Reservoir only). The physical conditions needed for either of these events to occur are not likely to be met on a regular basis to allow for documentation of the take.
- Incidental take from predation is difficult to detect due to the rapid decomposition of food items in the stomach of a predator. Because predation is not expected to be a regular occurrence, finding the predator within the limited time window post-predation is highly unlikely.
- Incidental take from harassment is difficult to detect because spinedace are small and any weakened individuals are not likely to be detected, and, unless the debilitation was serious, would not be obvious to an observer.

The presence of stocked rainbow trout in occupied spinedace habitat in East Clear Creek above or below CC Cragin Reservoir, at occupied spinedace habitat in Leonard Canyon below Knoll Lake or Nutrioso Creek above or below Nelson Reservoir is a surrogate measure to measure the amount of incidental take occurring. Stocked trout can usually be distinguished from wild trout by experienced observers, so identification of any trout captured can be accomplished in the field. In the 2001 biological opinion for rainbow trout stocking at these three stocking sites, incidental take would be exceeded for any of the three lakes if more than one spinedace was found in the stomach of a tagged rainbow trout or more than 10 tagged rainbow trout were taken from below the lake in any one year. We will continue to use this level for this incidental take statement.

## EFFECT OF THE TAKE

In this biological opinion, the AESO determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

## REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS (as appropriate)

The following reasonable and prudent measures are necessary and appropriate to minimize take of Little Colorado spinedace:

1. AGFD shall monitor for stocked rainbow trout escaping from CC Cragin Reservoir, Knoll Lake, and Nelson Reservoir.
2. AGFD shall monitor incidental take resulting from the proposed action and report to the FWS the findings of that monitoring.

## TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, WSFR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Implementation of these terms and conditions is part of the CAMP.

The following term and condition implements reasonable and prudent measure #1 for Little Colorado spinedace:

1. AGFD shall continue to implement the monitoring protocols contained in the 2001 biological opinion (USFWS 2001c) as part of the proposed action. These actions are described elsewhere and are not repeated here.

The following term and condition implements reasonable and prudent measure #2 for Little Colorado spinedace:

1. In years when incidental take monitoring occurs, AGFD shall submit to WSFR a report of that monitoring either with the annual report on implementation of the CAMP, or, if there is no CAMP report scheduled for that year, by the due date normally set for the delivery of the CAMP report. WSFR will submit the incidental take monitoring report to AESO within the timeline set for reporting on implementation of the CAMP.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. WSFR, using information provided by AGFD, must immediately provide an explanation of the causes of the taking and review with the AESO the need for possible modification of the reasonable and prudent measures.

### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

## **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the

purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for Little Colorado spinedace contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery actions for spinedace under the auspices of the CAMP provides conservation benefits to spinedace that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### **Loach Minnow (*Tiaroga cobitis*) and critical habitat**

#### **DESCRIPTION OF THE PROPOSED ACTION**

Loach minnow and its critical habitat may be affected by stocking into five sites in the Black River drainage (Ackre Lake, Big Lake, Crescent Lake, East Fork Black River and West Fork Black River), Luna Lake on the San Francisco drainage, and seven sites on the Verde River (Table 9). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. Critical habitat units that are only proposed for listing are indicated by a (P).

Table 9: Stocking sites, sportfish species proposed for stocking, and potentially affected loach minnow populations and/or designated or proposed critical habitat.

| <b>Stocking complex/site</b> | <b>Species to be stocked</b> | <b>Loach minnow population affected</b> | <b>Critical habitat unit affected</b>                                          |
|------------------------------|------------------------------|-----------------------------------------|--------------------------------------------------------------------------------|
| <i>Black River</i>           |                              |                                         |                                                                                |
| Ackre Lake                   | ONAP, THAR                   | East Fork Black River                   | East Fork Black River (including North Fork), Boneyard Creek, Coyote Creek (P) |
| Big Lake                     | ONMY, SAFO, ONCL, ONAP       | East Fork Black River                   | East Fork Black River (including North Fork), Boneyard Creek, Coyote Creek (P) |
| Crescent Lake                | ONMY, SAFO                   | East Fork Black River                   | East Fork Black River (including North Fork), Boneyard Creek, Coyote Creek (P) |
| East Fork Black River        | ONAP, ONMY*                  | East Fork Black River                   | East Fork Black River (including North Fork), Boneyard Creek, Coyote           |

|                            |                        |                       |                                                                                |
|----------------------------|------------------------|-----------------------|--------------------------------------------------------------------------------|
|                            |                        |                       | Creek (P)                                                                      |
| West Fork Black River      | ONAP                   | East Fork Black River | East Fork Black River (including North Fork), Boneyard Creek, Coyote Creek (P) |
| <i>San Francisco River</i> |                        |                       |                                                                                |
| Luna Lake                  | ONMY, ONCL             | San Francisco River   | San Francisco River, Tularosa River, Negrito Creek                             |
| <i>Verde River</i>         |                        |                       |                                                                                |
| Goldwater Lake             | ONMY, LEMA, PONI, MISA |                       | Granite Creek (P), Verde River (P)                                             |
| Watson Lake                | ONMY*, LEMA, PONI      |                       | Granite Creek (P), Verde River (P)                                             |
| Willow Springs Lake        | ONMY*, LEMA, PONI      |                       | Granite Creek (P), Verde River (P)                                             |
| Middle Verde River         | ONMY                   |                       | Verde River (P), Fossil Creek (P)                                              |
| Oak Creek                  | ONMY                   |                       | Verde River (P), Oak Creek (P)                                                 |
| Wet Beaver Creek           | ONMY                   |                       | Verde River (P), Beaver and Wet Beaver Creek (P)                               |
| Green Valley Lake          | ONMY                   |                       | Fossil Creek (P)                                                               |

#### Conservation measures included in the proposed action

Loach minnow is a priority species for conservation in the proposed action and as such, will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

In coordination with AESO, ASNF, and USBR, AGFD will commit to provide for two loach minnow populations either through securing existing but threatened populations or establishment of new conservation populations. These efforts are over and above those included in the USBR funded Gila River Basin Native Fishes Conservation Program for the loach minnow. The first population will be initiated within four years and the second population within six years.

In the event of insufficient Apache trout to meet annual recreational stocking demands, the East Fork Black River shall be stocked with Apache trout only after those recreational stocking sites that are associated with a recovery population (i.e., West Fork Black River, West Fork Little Colorado River at Sheeps Crossing, and Lee Valley Lake). Any rainbow trout that are stocked into the East Fork Black River shall be sterile triploids to avoid any augmentation to the reproducing population of rainbow trout in the East Fork Black River. This measure will be ongoing and will be implemented as needed

If a spill from Big Lake or Crescent Lake is anticipated, AGFD shall install a fish weir to capture fish and prevent downstream movement. If the weir is not installed prior to a spill, a survey for nonnative trout species in the occupied habitat of the loach minnow will be completed within that spring/summer season. All nonfish species encountered during that survey will be removed. This measure will be implemented as needed.

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild or reintroduced populations of loach minnow.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

In coordination with partners, the AGFD shall develop and implement a standard survey schedule and procedures to evaluate fish community with emphasis on stocked trout presence in the loach minnow occupied areas of the East Fork Black River drainage. The first survey shall be completed by the third year.

AGFD shall share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and gartersnake populations in the San Francisco River drainage

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

Loach minnow was listed as a threatened species on October 28, 1986 (USFWS 1986). Although it is currently listed as threatened, the FWS determined in 1994 that a petition to uplist the species to endangered status is warranted (USFWS 1994b). The FWS confirmed this decision in 2000 (USFWS 2000). A reclassification proposal to list the species as endangered was published with the latest critical habitat proposal on October 28, 2010 (USFWS 2010e). For the purposes

of this consultation, the loach minnow is a threatened species with designated critical habitat, and a species proposed for endangered status with proposed critical habitat.

### Critical habitat

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species’ eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (USFWS and NMFS 1998b). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

For loach minnow, the role of each critical habitat unit in recovery was not defined in the recovery plan. For this analysis, we shall assume that any significant effects to the PBFs of critical habitat could result in a loss of conservation value for that critical habitat unit.

Critical habitat was designated on March 21, 2007 (USFWS 2007a). Following a legal challenge to that designation, we filed a motion for voluntary remand to develop a new critical habitat proposal. The proposed rule for the new critical habitat designation was published on October 28, 2010 (USFWS 2010e). Those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized in October, 2011. The Loach Minnow Recovery Plan was signed in 1991 (USFWS 1991a). There are some proposed critical habitat units that are not in the currently designated critical habitat; all potentially affected units will be addressed.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the loach minnow. This information was taken from the 2007

critical habitat designation (USFWS 2007a) and the 2008 Species Assessment and Listing Priority Assignment Form developed for the annual Candidate Notice of Review (USFWS 2008f). Information in these documents is incorporated by reference.

### Life history

Loach minnow is a small fish from the minnow family Cyprinidae. Loach minnow are olivaceous in color, and highly blotched with darker spots. Whitish spots are present at the front and back edges of the dorsal fin, and on the dorsal and ventral edges of the caudal fin. A black spot is usually present at the base of the caudal fin. Breeding males have bright red-orange coloration at the bases of the paired fins and on the adjacent body, on the base of the caudal lobe, and often on the abdomen. Breeding females are usually yellowish on the fins and lower body (Minckley 1973, USFWS 1991a).

The limited taxonomic and genetic data available for loach minnow indicate there are substantial differences in morphology and genetic makeup between remnant loach minnow populations. Tibbets (1993) concluded that results from mitochondrial DNA and allozyme surveys indicate variation for loach minnow follows drainage patterns, suggesting little gene flow among rivers. The levels of divergence present in the data set indicated that populations within rivers are unique, and represent evolutionarily independent lineages. The main difference between the mtDNA and allozyme data was that mtDNA suggest that the San Francisco/Blue and Gila groups of loach minnow are separate, while the allozyme data places the Gila group within the San Francisco/Blue group. Tibbets (1993) concluded that the level of divergence in both allozyme and mtDNA data indicated that all three main populations (Aravaipa Creek, Blue/San Francisco Rivers, and Gila River) were historically isolated and represent evolutionarily distinct lineages. The Black River lineage is genetically distinct from the San Francisco/Blue and Gila groups.

### Habitat use

Loach minnow is a bottom-dwelling inhabitant of shallow, swift water over gravel, cobble, and rubble substrates (Rinne 1989, Propst and Bestgen 1991). Loach minnow uses the spaces between, and in the lee of, larger substrate for resting and spawning (Propst et al. 1988; Rinne 1989). It is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Some studies have indicated that the presence of filamentous algae may be an important component of loach minnow habitat (Barber and Minckley 1966). Loach minnow feeds exclusively on aquatic insects (Schrieber 1978, Abarca 1987). Loach minnow live two to three years with reproduction occurring primarily in the second summer of life (Minckley 1973, Sublette *et al.* 1990). Spawning occurs March through May (Britt 1982, Propst et al. 1988); however, under certain circumstances loach minnow also spawn in the autumn (Vives and Minckley 1990). The eggs of loach minnow are attached to the underside of a rock that forms the roof of a small cavity in the substrate on the downstream side. Limited data indicate that the male loach minnow may guard the nest during incubation (Propst et al. 1988, Vives and Minckley 1990).

### Current distribution

Loach minnow is endemic to the Gila River basin of Arizona and New Mexico within the United States, and Sonora, Mexico, where it was recorded only in the Rio San Pedro. Historically, loach minnow in Arizona were found in the Salt River mainstem near and above the Phoenix area, the White River, East Fork White River, Verde River, Gila River, San Pedro River, Aravaipa Creek, San Francisco River, Blue River, and Eagle Creek, as well as some tributaries of these streams. In New Mexico, loach minnow historically occupied the Gila River including its West, Middle, and East Forks, the San Francisco River, the Tularosa River, and Dry Blue Creek (Minckley 1973, Minckley 1985).

The status of loach minnow is declining rangewide. The species is now common only in Aravaipa Creek (Arizona Game and Fish Department and Arizona State University unpub. data), the Blue River (AGFD 1994, Bagley et al. 1998), and limited portions of the San Francisco, upper Gila, and Tularosa rivers in New Mexico (New Mexico Department of Game and Fish unpub. data, Paroz et al. 2006, Propst 2002, Propst 2005). Although it has been found further downstream in the upper Gila River than at the time of listing as threatened (October 28, 1986; 51 FR 39478) (Propst and Stefferud unpub. data, Propst 1998, Rinne et al. 1999), its populations in some areas of the upper Gila, such as the Middle Fork, are much more precarious than at listing (Propst and Stefferud unpub. data). Since its listing, loach minnow have been found in small areas of several tributary streams to known populations in Aravaipa Creek and the Blue and Tularosa rivers, such as Pace, Frieborn, Negrito, Turkey and Deer creeks (Bagley et al. 1998). Since listing, two populations of loach minnow have been discovered, one in Eagle Creek (Knowles 1994) and one in the Black River (Bagley et al. 1996). However, following a wildfire in the Black River watershed, a salvage rescue operation in 2004 in the area known to be occupied resulted in the capture of only two loach minnow (USFWS unpub. data). The East Fork Black River population was adversely affected by the 2011 Wallow Fire that burned in the headwaters of this stream. Post-fire runoff of ash and sediment may have resulted in some level of mortality to the loach minnow in this stream. Both of these new populations appear to be very small and precarious, but each represents a remnant portion of the historical range that was thought to be occupied. Little information is available on the White River population.

### Threats

Threats to loach minnow were summarized in the 2008 Species Assessment and Listing Priority Assignment Form for the annual Candidate Notice of Review (USFWS 2008f). Threats include loss of habitat due to groundwater pumping, surface water diversions, impoundments, improperly managed livestock grazing, wildfire, land conversion for mining, agriculture or urban developments, and the introduction of nonnative invertebrates, amphibians (bullfrogs), and fish that compete with, prey on, or transmit novel parasites or diseases to loach minnow. As recently demonstrated, wildfire is also a threat to loach minnow and the quality of its habitat.

### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the loach minnow recovery plan.

Ongoing conservation actions for the loach minnow are provided by the Central Arizona Project



Gila River Basin Native Fishes Conservation Program (CAP Program). The CAP Program is federally funded and implements surveys and monitoring, barrier construction with subsequent renovations to remove nonnative fish species and stocking of loach minnow and other native species, and collection of loach minnow for hatchery-rearing to provide individuals for repatriation. Stocking of loach minnow into Fossil Creek, Muleshoe Ecosystem (Hot Springs and Redfield Canyon), and Bonita Creek have proceeded under the Program. Augmentations with additional fish will occur for the next several years. Monitoring will be conducted at each of these sites to determine if populations ultimately become established at these new locations. Loach minnow are also a covered species in the Horseshoe-Bartlett HCP (SRP 2008).

As part of the above programs, a captive breeding facility was constructed and staffed in 2007 at the Bubbling Ponds Fish Hatchery. Loach minnow from Aravaipa Creek and the Blue River in Arizona and the Gila River in New Mexico are currently at the facility, and plans are underway to bring in stock from every extant population of loach minnow. Bubbling Ponds will serve as a refugium for some populations, and as a captive breeding facility for others, depending on status of the population and availability of translocation sites.

#### *Critical habitat*

In Arizona, the current designation (USFWS 2007c) includes portions of the Black River, East Fork Black River, North Fork East Fork Black River, and Boneyard Creek; Aravaipa Creek and its tributaries Deer and Turkey creeks; the San Francisco River, Eagle Creek, and the Blue River and its tributaries, Campbell Blue Creek and Little Blue Creek. In New Mexico, the current designation includes portions of the Blue River; the San Francisco River and its tributary Whitewater Creek; the Tularosa River and its tributary, Negrito Creek; Campbell Blue Creek; Dry Blue Creek and its tributaries Frieborn and Pace creeks; the Gila River, including portions of its West, Middle, and East forks.

When critical habitat was designated, the FWS determined the physical and biological features (PBFs) for loach minnow. PBFs include those habitat features required for the physiological, behavioral, and ecological needs of the species. Units are designated based on sufficient PBFs being present to support one or more of the species' life history functions. Some units contain all PBFs and support multiple life processes, while some units contain only a portion of the PBFs necessary to support the species' particular use of that habitat. Where a subset of the PBFs is present at the time of designation, this rule protects those PBFs and thus the conservation function of the habitat. For loach minnow, PBFs include:

- 1) Permanent, flowing water with no or minimal levels of pollutants (Baker 2005);
- 2) Living areas with appropriate flow velocities and depths for the various life stages of the fish, as follows (Table 10):

Table 10: Flow velocities and depths for life stages of loach minnow

| PBFs | Life stage of loach minnow | Parameters |
|------|----------------------------|------------|
|------|----------------------------|------------|

|                 |          |                                    |
|-----------------|----------|------------------------------------|
| Flow velocities | Adult    | 9 to 32 in./sec. (24 – 80 cm/sec.) |
|                 | Juvenile | 1 to 34 in./sec (3 – 85 cm/sec.)   |
|                 | Larval   | 3 to 20 in./sec (9 – 50cm/sec.)    |
| Depth           | Adult    | 1 – 30 in. (3 cm – 75 cm)          |
|                 | Juvenile | 1 – 30 inches (3 cm - 75 cm)       |
|                 | Larval   | Shallow areas                      |

Spawning areas are also required, and should have slow to swift flow velocities in shallow water where cobble and rubble and the spaces between them are not filled in by fine dirt or sand (Barber and Minckley 1966, Propst et al. 1988, Propst and Bestgen 1991, Rinne 1989).

3) Water with dissolved oxygen levels (approximately 3.5 cubic centimeters per liter or greater) and no or minimal pollutant levels for pollutants such as copper, arsenic, mercury, and cadmium; human and animal waste products; pesticides; suspended sediments; and gasoline or diesel fuels (Baker 2005);

4) Sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness, which are generally maintained by a natural, unregulated hydrograph that allows for periodic flooding, or, if flows are modified or regulated, a hydrograph that allows for adequate river functions, such as flows capable of transporting sediments (Propst et al. 1984, Propst et al. 1988, Propst and Bestgen 1981, Rinne 1989, Rinne 2001).

5) Streams that have low gradients of less than approximately 2.5 percent (Rinne 1989, Rinne 2001).

6) Water temperatures in the approximate range of 35 to 82 degrees Fahrenheit (°F) (1.7 to 27.8 degrees Celsius (°C)) with additional natural daily and seasonal variation (Bonar et al. 2005, Britt 1982, Leon 1989, Propst et al. 1988, Propst and Bestgen 1991, Vives and Minckley 1990).

7) Pool, riffle, and run habitat components (AGFD 1994, Bagley et al. 1995, Barber and Minckley 1966, Britt 1982, J.M. Montgomery 1985, Marsh et al. 2003, Propst et al. 1984, Propst et al. 1988, Propst and Bestgen 1991, Rinne 1989, Vives and Minckley 1990).

8) An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies (Propst et al. 1988, Propst and Bestgen 1991, Schreiber 1978).

9) Habitat devoid of aquatic species or habitat in which aquatic species are at levels that allow persistence of loach minnow (Anderson 1978; Bonar et al. 2004; Carlson and Muth 1989; Courtenay and Meffe 1989; Douglas et al. 1994; Fuller et al. 1990; Lachner et al. 1970; Lassuy 1995, Miller 1961; Minckley 1985; Minckley and Deacon 1991; Moyle 1986; Moyle et al. 1986; Ono et al. 1983, Propst et al. 1986, Williams et al. 1985), and;

10) Areas within perennial, interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted.

The PBFs are generalized descriptions and ranges of selected habitat factors that are critical for the survival and recovery of loach minnow. The appropriate and desirable level of these factors may vary seasonally and is highly influenced by site-specific circumstances. Therefore, assessment of the presence/absence, level or value of the PBFs must include consideration of the season of concern and the characteristics of the specific location. The PBFs are not independent of each other and must be assessed holistically, as a functioning system, rather than individually. In addition, the PBFs need to be assessed in relation to larger habitat factors, such as watershed, floodplain, and streambank conditions, stream channel geomorphology, riparian vegetation, hydrologic patterns, and overall aquatic faunal community structure.

Critical habitat was designated in four separate complexes for loach minnow, including the Black River Complex, the Middle Gila/Lower San Pedro/Aravaipa Creek Complex, the San Francisco/Blue River Complex, and the Upper Gila River Complex. The Black River Complex includes 12.2 miles of the East Fork Black River, 4.4 miles of the North Fork East Fork Black River, and 1.4 miles of Boneyard Creek. Within this complex, the last record of loach minnow on the East Fork and North Fork East Fork Black rivers was in 2004 (AGFD 2004, ASU 2002). The last record of loach minnow from the vicinity of Boneyard Creek was in the East Fork Black River near the mouth of Boneyard Creek and was in 1996 (AGFD 2004, ASU 2002). Surveys in 2004 located only two individuals in the forks of the Black River. No loach minnow have been found in the Black River complex since 2005. This complex was adversely affected by the Wallow Fire, and there may have been mortality of loach minnow and changes to the habitat-based PBFs due to the fire itself and post-fire runoff of ash and sediment.

Within the Middle Gila/Lower San Pedro/Aravaipa Creek Complex, no portions of the Middle Gila or Lower San Pedro rivers are included for loach minnow. Twenty-eight miles of Aravaipa Creek, 2.3 miles of Deer Creek and 2.7 miles of Turkey Creek are included as critical habitat for loach minnow. Aravaipa Creek supports one of the largest and most protected loach minnow populations due to special use designations on Bureau of Land Management (BLM) land, substantial ownership by The Nature Conservancy, and a completed fish barrier at its lower end designed to prevent invasion of nonnative fish species.

The San Francisco and Blue rivers Complex includes approximately 235 miles of critical habitat for loach minnow. This mileage includes 17.7 miles on Eagle Creek, 126.5 miles on the San Francisco River in both Arizona and New Mexico, 18.6 miles on the Tularosa River, and 51.1 miles on the Blue River. Mileage is also included along Negrito, Whitewater, Campbell Blue, Dry Blue, Pace, Frieborn, and Little Blue creeks. Loach minnow were documented in the San Francisco/Blue rivers Complex in 2008 (Propst et al. 2009) and in 2011 (T. Robinson, AGFD, pers. comm.).

Critical habitat within the Upper Gila River Complex includes approximately 94.9 miles of the Gila River, 26.1 miles of the East Fork Gila River, 11.9 miles of the Middle Fork Gila River, and 7.7 miles of the West Fork Gila River. Loach minnow were detected in the Gila River in annual surveys last conducted in 2006 (2007 surveys are pending). They were last detected in the East Fork Gila River in 1998 (Propst 2002, Propst 2006, in the Middle Fork Gila River in 1998 (Paroz et al. 2006, Propst 2002, Propst 2006), and in the West Fork Gila River in 2002 (Paroz et al. 2006, Propst 2002, Propst 2006). This complex contains the largest remaining population of

loach minnow.

The October 28, 2010, proposed rule for critical habitat included all the designated critical habitat reaches and new sites in several drainages (USFWS 2010d). In the Verde River, critical habitat was proposed for the loach minnow on the mainstem from Sullivan Lake to the confluence with Wet Beaver Creek, the lower two miles of Granite Creek above its confluence with the Verde River, 33.7 miles of Oak Creek upstream from its confluence with the Verde River, 20.8 miles of Beaver Creek and Wet Beaver Creek upstream from the Beaver Creek confluence with the Verde River, and 4.7 miles of Fossil Creek from its confluence with the Verde River. Of these proposed critical habitat areas, only Fossil Creek may contain loach minnow at the present time if they move out of the stocking reach above the critical habitat boundary.

The PBFs for the October 28, 2010, proposed critical habitat for loach minnow are:

1. Habitat to support all egg, larval, juvenile, and adult loach minnow. This habitat includes perennial flows with a stream depth of generally less than 1 m (3.3 ft), and with slow to swift flow velocities between 0 and 80 cm per second (0.0 and 31.5 in. per second). Appropriate microhabitat types include pools, runs, riffles, and rapids over sand, gravel, cobble, and rubble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitats have a low stream gradient of less than 2.5 percent, are at elevations below 2,500 m (8,202 ft). Water temperatures should be in the general range of 8.0 to 25.0 °C (46.4 to 77 °F);
2. An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;
3. Streams with no or no more than low levels of pollutants;
4. Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;
5. No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low to allow persistence of loach minnow; and
6. Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments.

#### *Previous consultations*

Section 7 consultations on loach minnow include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on road crossings, water withdrawals, and implementing recovery actions such as barrier construction and stream renovations. Biological opinions on actions potentially affecting loach minnow may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

### **Description of the Action Area**

There are three action areas for the proposed action. Each will be considered separately.

#### *Black River*

The Black River action area includes the connected watershed of the Black River and includes Big Lake, Crescent Lake, the East and West Forks of the Black River, and the Black River down to its confluence with Fish Creek (Ackre Lake is in the headwaters of Fish Creek) This action area encompasses the stocking sites and the hydrologically connected portions of the drainage that may contain stocked sportfish that have moved from the stocking sites on their own or via spills from the three lakes. Critical habitat for the loach minnow is in the East Fork of the Black River and connected tributaries.

#### **A. Status of the species and critical habitat within the action area**

Loach minnow were documented in the Black River in 1996 (Marsh et al. 2003), and surveys through 2005 continued to document the species (Robinson et al. 2008). The status of the loach minnow population is unclear, since they are difficult to survey for, and the numbers captured in each effort have varied. Bagley et al. (1996) reported all age classes were present in surveys from Three Forks to ¼ mile above Open Draw (Bagley et al. 1996), establishing the population within at least 2.25 miles of river. Marsh et al. (2003) reported loach minnow were found in the reach in every survey from 1997-2002. Numbers since 2004 have been low, with only three in 2004, one in 2005, and none in 2007, 2008 or 2009. The retardant drop in the vicinity of Three Forks in 2004 had adverse effect to the Three Forks springsnail (USFWS 2007d) and may also have affected the fish community in the vicinity. Native fish (speckled dace, desert sucker, and Sonora sucker) numbers in 2000-2001 compared to 2007-2008 (Tables 11 and 12) were significantly higher, implying something had happened to the system between 2001 and 2007. While some rebound is seen in 2008 for speckled dace, that is not the case for the suckers (Robinson et al. 2008). The long-term drought may also be a factor in the changes to the fish community over the last 10 years.

Table 11: North Fork of East Fork of Black River 2000 and 2001 survey data from 47 survey sites.

| <b>Species Collected</b> | <b>Number Collected</b> |
|--------------------------|-------------------------|
| Speckled dace            | 15,497                  |
| Loach minnow             | 28                      |

|                |       |
|----------------|-------|
| Desert sucker  | 1,839 |
| Sonora sucker  | 162   |
| Brown trout    | 34    |
| Hybrid trout   | 15    |
| Fathead minnow | 1,915 |

Table 12: North Fork of East Fork of Black River 2007 and 2008 survey data. Sites surveyed may not be identical between years.

| Species Collected   | Number Collected by Year |      |
|---------------------|--------------------------|------|
|                     | 2007                     | 2008 |
| Speckled dace       | 286                      | 753  |
| Desert sucker       | 92                       | 39   |
| Sonora sucker       | 1                        | 0    |
| Unidentified sucker | 0                        | 2    |
| Brown trout         | 8                        | 30   |
| Hybrid trout        | 0                        | 4    |

The population of loach minnow in the Black River is small and significantly reduced from what was probably a much wider extent in the drainage (USFWS 2007c). Past actions including construction of lakes that changed how water flowed through the drainage, improper livestock grazing, road construction and maintenance that affect watershed conditions that alter sediment contributions to the streams, development and use of recreation sites that also alter vegetation communities and alter sediment inflows, forestry management practices that contribute to wildfire risk and subsequent suppression activities, and the introduction of nonnative fish species such as rainbow trout and brown trout that may prey on or compete with loach minnow have contributed to the current status of the species in the Black River.

At the time of designation, the critical habitat reach was considered essential to the conservation of the loach minnow. The conservation role for this (and all) designated critical habitat was to support viable core area populations. The Black River units contained the last known occupied habitat for the loach minnow in the Black River drainage, and, protected the unique evolutionary lineage of loach minnow found there. This lineage may be related to the White River lineage; however, we have no genetic data on fish from the White River. The critical habitat was described as containing several of the PBFs, particularly those relating to flows, physical gradients, and appropriate riffle habitats. Special management needs were identified for recreational use, nonnative fish species, and forestry management in light of the 2004 wildfire to reduce effects to the relevant PBFs. The conditions of the physical habitat portions of the PBFs, particularly for microhabitats and food base may be degraded by the effects of the Wallow Fire. The extent of the potential damage is unknown and until the watershed recovers, may continue to occur over time.

At the time of critical habitat designation, nonnative fish present in the Black River reach included wild brown trout, wild rainbow trout, hybrid (Apache x rainbow) trout, and fathead minnow. Other nonnative species, particularly crayfish, were also present. Nonnative trout presence in the critical habitat resulted from past stockings into the East Fork; with brook trout

last stocked in 1940, brown trout in 1981, and rainbow trout in 1996. Since 1996, native Apache trout are the only trout species stocked into the East Fork Black River critical habitat reach. Other species, including Apache trout, brook trout, and rainbow trout were and are stocked into Big and/or Crescent Lake and may be the original source of brook trout now breeding in Boneyard Creek in 2008 (Robinson et al. 2008). The source of the fathead minnows and crayfish is unclear; however, fathead minnows were likely introduced into Arizona for use as live bait around 1952 (Minckley 1973) and was widely distributed by bait bucket releases. Crayfish are not native to Arizona and were introduced into the White Mountains area in the 1970s and appeared near Three Forks in 1993 (Fernandez and Rosen 1996). Crayfish were present in Big Lake in the 1970s (Rick Law, Big Lake Store concessionaire, pers. comm.) and were abundant at Buffalo Crossing on the East Fork in 1988 (Mike Lopez, AGFD, pers. comm.). The potential for loach minnow interaction with fathead minnows is limited; however, crayfish have significant effects on habitat structure and the invertebrate population base that could adversely affect PBFs as well as direct predation on loach minnow. If there was a fish kill in the Black River critical habitat unit following the Wallow Fire, the populations of nonnative fish may have been significantly reduced. Of particular concern to loach minnow are wild brown trout, and any reduction in their population could be beneficial to improving the status of PBF 9 or 5 if that nonnative population does not rebound.

## **B. Factors affecting the species' environment and critical habitat within the action area**

Land management actions by the Apache-Sitgreaves National Forests are addressed in the Forests' Land Management Plan, which is subject to section 7 consultation with the USFWS to assess impacts to loach minnow from recreation, livestock grazing, forestry practices, and other land management programs.

The loach minnow in the Black River was considered in the 1994 comprehensive review of federally funded sportfish stocking due to the potential for them to be present in the drainage; however, a finding of "no effect" was made since the species was not documented to occur in the stocking areas. Loach minnow were found above the East Fork stocking site in 1996 but no consultation was reinitiated. Effects to critical habitat were not included as critical habitat was not completed until 2007. Ongoing conservation actions for the loach minnow in the Black River are related to the CAP Program, and consist of surveys to locate loach minnow to capture individuals for captive propagation at Bubbling Ponds State Fish Hatchery to provide individuals for later translocation (Robinson 2010).

We believe the precarious condition of the loach minnow population in the Black River is due to past management actions, both for land management and recreation including establishing sport fisheries with nonnative species. Present and future land management is subject to implementation of the Land Management Plan, including required monitoring of wildlife populations. Effects from sportfish stockings in the drainage continue to pose a risk to loach minnow.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical

habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the loach minnow are in the final rule (USFWS 1986a), the recovery plan (USFWS 1991a), the critical habitat designation (USFWS 2007c), and the 2008 CNOR (USFWS 2008f). All these documents are incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on loach minnow.

As described in the interactions document in Appendix D, stocked rainbow trout do not persist long in the stream after the stocking event due to a number of factors including natural mortality events, angler catch, and predation by other species (such as brown trout or smallmouth bass) on the stocked trout. The repeated stockings are necessary to maintain a fishable population under these conditions. Stocked rainbow trout can and do convert to eating natural foods if they live long enough to do so, and can be predators on small fish at that time. The number of times that potential predation event can be realized is difficult to determine since for the event to occur, the individual stocked rainbow trout must survive long enough to convert to natural feeding and access the occupied habitat of the native fish.

Stocking sportfish into the five Black River stocking sites would affect loach minnow if individual stocked fish moved from their stocking sites via hydrological connectivity to the occupied loach minnow habitat around Three Forks on the East Fork Black River. There is no stocking directly into what is considered “occupied” loach minnow habitat; however, expansion of loach minnow populations downstream in the East Fork Black River critical habitat unit may be impeded by stocking in that reach. The potential for that movement is considered in the BA, and the degree of risk varies between sites, with the lowest risk at Ackre Lake and, in order of increasing risk, Crescent Lake, West Fork Black River, Big Lake, and the highest on the East Fork Black River, where sportfish are stocked 2.1 miles downstream of occupied loach minnow habitat.

The repeated stockings into the sites over the stocking season is of particular concern for the East Fork Black River site, as the number of nonnative fish increases and decreases repeatedly over the season and this is the closest stocking site to occupied habitat and has a permanent hydrological connection. Apache trout, the trout native to the Black River (where it was likely co-located in occupied loach minnow streams) would normally be stocked in this reach; however, when they are not available, triploid rainbow trout would be stocked. Each stocking event has the potential for a large number of stocked trout to move through the system. However, surveys of the East Fork Black River found very few trout outside of the stocking reach, and very few stocked trout persisted for more than two months. One Apache trout was recorded in the occupied habitat in 2008 (Robinson et al. 2008) which could have been a stocked



fish from the East Fork Black River stocking site. The brook trout also captured in the occupied habitat in 2008 may have come from the wild population in Boneyard Creek. Other surveys by AGFD in this area are summarized in the BA.

Cutthroat trout are not particularly piscivorous (Behnke 1992, Carlander 1969), nor is Apache trout (Behnke 2002, Clarkson and Dreyer 1996) although small fish may be eaten opportunistically. The fact that two species may have occurred in the same stream historically does not preclude the existence of competition between the two or predation by the native trout on the loach minnow, particularly as stocking a fish into a stream does not recreate the conditions under which the two species may have coexisted. Brook trout are more piscivorous than rainbow trout. Stocked rainbow trout have been documented feeding on loach minnow (Propst et al. 1998), and while in occupied habitat could prey on small loach minnow. The use of only triploid rainbow trout in the East Fork Black River essentially eliminates the risk that these trout could support (or reestablish) the wild rainbow trout population in this stream, which reduces a long-term predation issue to a short-term issue.

The conservation measure for the weir below Big Lake will significantly reduce the risk of sportfish from Big Lake or Crescent Lake from entering occupied habitat downstream. Since trout do not reproduce in these lakes and the weir is sized to capture adults, escapement potential is reduced, and if the weir is not put in place, surveys in the following spring or summer will attempt to remove any trout that did access the stream.

While loach minnow are primarily considered to occupy riffle habitats, they were found in relatively slow runs in the North Fork of the East Fork, and, in Pace Creek, in long pools (Marsh et al. 2003). Microhabitats within the stream are important and vary by life stage and stream. Adult loach minnow occupy a broad range of water velocities, with the majority of adults occurring in swift flows. In the Gila and San Francisco rivers, the majority of loach minnow captured occurred in the upstream portion of a riffle, rather than in the central and lower sections of the riffle, where loose materials are more likely to fall out of the water column and settle on the stream bottom. Substrate is an important component of loach minnow habitat. Studies in Aravaipa Creek and the Gila River indicate that loach minnow prefer cobble and gravel, avoiding areas dominated by sand or finer gravel. This may be because loach minnow maintain a relatively stationary position on the bottom of a stream in flowing water. An irregular bottom, such as that created by cobble or larger gravels, creates pockets of lower water velocities around larger rocks where loach minnow can remain stationary with less energy expenditure (Turner and Tafaelli 1983).

Loach minnow eggs are adhesive, and are placed on the undersurfaces of rocks in the same riffles that they themselves occupy. Larval loach minnow move from the rocks under which they spawned to areas with slower velocities than the main stream after emergence, typically remaining in areas with significantly slower velocities than juveniles and adults. Larval loach minnow occupied areas that were shallower and significantly slower than areas where eggs were found (Propst et al. 1988; Propst and Bestgen 1991). Juvenile loach minnow generally occur in areas where velocities are similar to those used by adults, and that had higher flow velocities than those occupied by larvae (Propst et al. 1988).

In general, trout use pool habitats more often than riffles, but will move into such areas to forage. Trout forage in the water column on drift and may utilize benthic inverts. Numbers of trout attempting to feed at a particular site problematic as resident trout (rainbow and brown) maintain feeding territories at the most optimal sites. While stocked trout not likely to occupy prime locations, they are likely to be in areas of any potential food resources and in numbers that significantly reduce the available drift of invertebrates or exploitable benthic populations. The competition for food and space between the stocked and resident trout may result in the stocked trout being displaced to less desirable habitats in riffles, where they would also seek lower velocity areas behind rocks and other deflectors, putting them in the vicinity of loach minnow.

Large numbers of stocked trout in available pools may displace natives or cause change in how habitat is used (Bryan et al. 2002). Such changes may result in effects to energy needs if sub-optimal habitat requires that more effort is expended to maintain position, effects to foraging if sub-optimal habitats do not contain best forage base, higher risk of predation by other species if sub-optimal habitat is more exposed with less cover, and loss of foraging time if active harassment by rainbow trout occurs as part of displacement interactions. Bryan et al. (2002) noted that rainbows can adversely affect the native fish populations through aggressive displacement through interference competition, using resources more quickly and efficiently through exploitative completion, increasing stress hormones, or by opportunistic piscivory. The use of triploid rainbow trout does not reduce the potential for effects from the stocked fish; however, because these cannot reproduce, they do not contribute to the wild rainbow trout population in the EFBR, so their effects are seasonal in nature.

Indirect effects to loach minnow also come from anglers pursuing stocked trout. Anglers wading in riffle areas may disturb rocks with egg masses underneath resulting in damage or destruction of the eggs through trampling. Anglers walking along the stream and entering the water can also result in damage to streambanks which may increase sediment inputs to the stream, which degrades the habitat through filling in interstitial spaces used by the loach minnow. Because anglers pursuing stocked trout are unlikely to be in the area currently considered occupied by loach minnow, this effect is minor. However, with the low density of loach minnow in the Black River, there may be some individuals outside of the boundaries of that occupied area, particularly downstream in the East Fork, which may be exposed to anglers.

There are direct effects to designated critical habitat in the East Fork Black River from the stocking of both native Apache trout and nonnative rainbow trout into the designated reach of the East Fork Black River. The difference in effects to PBF 9 or 5 is that Apache trout are native species and rainbow trout are not. Stocking Apache trout does not affect PBF 9 or 5, but the effects to PBF 8 or 2 (food resources) are equal for both species. Stocked trout from Big Lake or Crescent Lake have a reduced opportunity to reach the critical habitat in the East Fork, North Fork of the East Fork, Boneyard Creek and proposed critical habitat in Coyote Creek due to the placement of the weir prior to predicted winter flooding events. Documentation of stocked species in the critical habitat area affects PBF 4: habitat devoid of aquatic species or habitat in which aquatic species are at levels that allow persistence of loach minnow (USFWS 2007c). At the time of designation of critical habitat in 2007, rainbow trout stocking was ongoing in the East Fork Black River and the presence of these fish and the reproducing population of rainbow trout also present was considered in the determination that this habitat area was essential to the

conservation of the loach minnow. The use of only triploid rainbow trout (in those years when Apache trout are not available) reduces the risk of establishing or supporting a wild rainbow trout population within the critical habitat under the proposed action. In the designation of critical habitat (USFWS 2007c), the North Fork of the East Fork, the East Fork Black River, and Boneyard Creek were acknowledged to support primary constituent elements related to habitat quality (sufficient flow velocities and appropriate gradients, substrates, depths, and habitat types [i.e. riffles, runs]). The suitability of these designated reaches to meet PBF 9 for the designated critical habitat and 5 for the proposed critical habitat was not specifically mentioned; however, special management needs relating to recreation pressure, nonnative species, and wildfire were identified for the Black River critical habitat area. Also, the final rule identified activities that could adversely affect the PBFs to the extent that the conservation value of the critical habitat is appreciably reduced, one of which was “actions intended to introduce, spread, or augment fish species” (USFWS 2007c). The use of only triploid rainbow trout in the East Fork Black River under the proposed action reduces the opportunity for those trout to reproduce and support the wild populations in the river. The primary species for stocking, Apache trout, are native to the river system and may have less adverse effect to PBF 9 or 5 than the past stocking of rainbow trout. The proposed action could be said to have fewer impacts to PBF 9 or 5 than previous stocking actions.

While these stocked trout are quickly caught out after each stocking event, while they are present they use space and some of the available food base provided by the critical habitat (affecting PBF 8 or 2) that may impede occupancy of that area by dispersing loach minnow from the occupied habitat area upstream. The stocking reach represents 6.75 miles of the total 12.2 miles of designated critical habitat on the East Fork Black River, and stocking of up to an annual total of 40,000 Apache and/or rainbow trout would occur between May and September (approximately 2,000-3,000 fish per week). Stocking is concentrated in pools in the angler-accessible locations within the 6.75 miles and not into the riffle areas where loach minnow could be present. The proposed action also covers a 10-year period with stocking occurring every year.

Angler use of the stocking site on the East Fork Black River may also affect PBF 2 or 1, particularly the component of clean sediment-free substrates. Angler disturbance of riparian vegetation and de-stabilizing streambanks may increase sediment inputs to the stream and affect this PBF (USFWS 2007c).

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The stocking sites and the action area are on Federal lands, and cumulative effects from non-Federal activities are unlikely.

The use of live baitfish is prohibited on the Black River in the action area. Waterdogs are legal; however, waterdogs are not used as bait for the fish species stocked under the proposed action;

Waterdogs are found in Big Lake and Crescent Lake. Collection of live crayfish for use as bait is allowed at the water to be fished but live crayfish cannot be transported away from the capture location. The Area-Wide analysis will look at the effects of illegal or inadvertent transport of unwanted aquatic organisms on the larger scale.

### *San Francisco River*

#### **Description of the action area**

The San Francisco River action area includes Luna Lake and extends down the San Francisco River to the native fish monitoring site near Glenwood, New Mexico. Suitable habitat for salmonids is only seasonally available in the San Francisco River at the monitoring site; however, stocked fish leaving Luna Lake during seasonal flood flows can reach the site even if they do not persist over the summer. Critical habitat for the loach minnow extends from near The Box (approximately 21 miles below Luna Lake) 126.5 miles downstream. Also potentially affected is the Tularosa River critical habitat, which extends 18.6 miles upstream of the confluence with the San Francisco to the town of Cruzville and 4.2 miles of lower Negrito Creek, a tributary of the Tularosa River.

#### **A. Status of the species and critical habitat within the action area**

Loach minnow occupy the San Francisco River, Tularosa River, and Negrito Creek within the action area. The occupied habitat begins approximately 26 miles below Luna Lake. Two long-term monitoring stations are in the action area, one on the Tularosa River and one at Glenwood on the San Francisco River. Data from 1988-2005 indicated that while density of native fishes declined over the period, diversity and species richness remained good (most years all five species were found). Nonnative densities did not change, and diversity and species richness remained low (Paroz et al. 2006). Propst et al. (2009) summarized fish capture data from 1988 through 2008 for native and nonnative species, and this information is provided below.

In 20 years of surveys at the Glenwood site (there were no surveys here in 2000), loach minnow were found in all years, with rainbow trout found in seven years (35 percent of the time), western mosquitofish found in five years (25 percent of the time), fathead minnows in four years (20 percent of the time), and largemouth bass in two years (10 percent of the time). Since 2001, five years of surveys had no nonnative fish recorded, and in the other three years, only one nonnative fish species was found (rainbow trout in 2001, western mosquitofish in 2003, and fathead minnow in 2007), and only in 2003 was the percentage of nonnative fish documented greater than 10 percent.

In 21 years of surveys at the Tularosa site, loach minnow were found in 14 years from 1988 through 2002, then were not found again until 2008 (71 percent of the time). Western mosquitofish were found in 10 years (48 percent of the time), fathead minnows in six years (28 percent of the time), and rainbow trout in one year (5 percent of the time). Brook stickleback, a fish known from the Canadian River drainage of New Mexico, was recorded in the Tularosa River in 2002. This species is not believed to be native to New Mexico, and was likely introduced to the Canadian River by anglers using it as bait (Sublette et al. 1990). The origin of

this species in the Tularosa River is unknown. Since 2001, three years of surveys had no nonnative fish recorded, and in the other five, two years had percentages of nonnative fish present of over 10 percent.

There are three critical habitat reaches that may be affected by the proposed action. The first is the San Francisco River from The Box (approximately 21 miles below Luna Lake) downstream 126.5 miles to the confluence with the Gila River. The portion of this critical habitat in the action area is from The Box to the NMDGF monitoring site near Glenwood. This reach is essential to the conservation of the loach minnow. PBFs present include sufficient flow velocities and appropriate gradients, substrates, depths, and habitat types. Special management needs for this reach include water diversions, improper livestock grazing, and nonnative fish species. The second is the Tularosa River from its confluence with the San Francisco River upstream 18.6 miles to Cruzville. This reach is essential to the conservation of the loach minnow. PBFs present include sufficient flow velocities and appropriate gradients, substrates, depths, and habitat types. Special management needs for this reach include improper livestock grazing and nonnative fish species. The third is Negrito Creek from its confluence with the Tularosa River upstream 4.2 miles to Cerco Canyon. This reach is considered essential to the loach minnow. PBFs present include sufficient flow velocities and appropriate gradients, substrates, depths, and habitat types. Special management needs for this reach include improper livestock grazing and nonnative fish species.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

Much of the action area is part of the Apache and Gila National Forests, and land management activities on the watershed are managed for multiple-use under the respective land management plans. There is some private land, particularly in the vicinity of Luna, Reserve, Alma and Glenwood on the San Francisco River, and above Cruzville on the Tularosa River. The San Francisco River has suffered from erosion and extensive water diversion and at present has an undependable water supply throughout much of its length. Much of the flow below Luna Lake is diverted for agricultural purposes, with permanent flow resuming about 5.5 miles downstream, which is above the upper boundary of the critical habitat at The Box. In the vicinity of Reserve and Glenwood there are agricultural areas and small towns on the private lands.

#### **EFFECTS OF THE ACTION**

Impacts to these loach minnow from stocking rainbow and/or cutthroat trout into Luna Lake are related to trout potentially escaping Luna Lake during times of the lake spilling (snow melt, monsoonal discharges, or from irrigation water releases through the headgate in the dam during summer months) and potentially moving downstream in the San Francisco River to occupied loach minnow habitats in that river and the Tularosa River and Negrito Creek. Predation on loach minnow by rainbow trout or cutthroat trout escaping the lake is the potential effect. Stocking of fingerlings, sub-catchables, and catchables at the lake assumes that at smaller trout will adapt to a natural diet and grow to catchable size. Those fish are more likely to be predators on loach minnow than those released as catchables. Trout are present in the lake all year and could be released at any time the lake spills.

Rainbow trout fishing is reportedly good between Luna, New Mexico and the Arizona stateline, as well as at the Frisco Box a few miles downstream of that. Cutthroat trout have not been documented in any surveys in the action area outside of Luna Lake. No trout are legally stocked in the San Francisco River in New Mexico, so the origin of these trout is unknown and some may originate in Arizona from Luna Lake. Wild rainbow trout are also found in the Tularosa River, and rainbows and rainbow-Gila hybrids are reported from South Fork of Negrito Creek and the mouth of North Fork of Negrito Creek, which in some years have some of the best trout fishing on the Gila National Forest (Johnson and Smorynski 1998). Rainbow trout in these systems are not supported by current stocking actions in New Mexico, and are most likely wild fish with self-sustaining populations. Based on the physical information about the reach of the San Francisco River from Luna Lake to occupied loach minnow habitat and critical habitat, including the distances involved, we expect limited numbers of rainbow trout from Luna Lake to access occupied loach minnow habitats and have effects on individual loach minnow through potential predation and competition for food resources. However, as a conservation measure, AGFD will share information with the New Mexico Department of Game and Fish (NMDGF) on salmonid populations in occupied habitats.

There are wild trout populations in portions of the designated and proposed critical habitat reaches in the upper San Francisco River drainage. The role of past stocking of rainbow trout into Luna Lake contributing to the establishment or maintenance of these wild trout populations is uncertain. However, the opportunity for rainbow trout from Luna Lake to contribute to the maintenance of these trout populations will be essentially eliminated due to the use of triploid rainbow trout for stocking at Luna Lake. That conversion will occur over a three-year schedule at the beginning of the 10-year period covered by this consultation. Any rainbow trout that did access the critical habitat might persist if conditions were appropriate; but the likely numbers of such fish added to the existing rainbow trout populations is not expected to significantly increase those wild populations and have an adverse effect on PBFs 9 or 5. If rainbow trout from Luna Lake are supporting the recruitment to the wild populations, then the proposed action could result in a net benefit by eliminating that support.

## CUMULATIVE EFFECTS

Luna Lake is on the Apache National Forest. Recreational facilities and the concession are managed or licensed by the Forest Service. Watershed activities are also managed by the Forest Service. Water releases from the lake are managed by the Luna Irrigation Company (which owns most of the water rights outside of a minimum pool right owned by AGFD). Below the lake along the San Francisco River, most of the land is on the Apache and Gila National Forests, with private inholdings concentrated at the towns of Luna, Reserve, Alma and Glenwood. Watershed management is primarily by the Forest Service, with local water use and development activities on private lands subject to limited Federal involvement.

Use of live baitfish at Luna Lake is prohibited, however, waterdogs are allowed. Fathead minnow and waterdogs are found in the lake, the initial sources of these species are unknown; however, fathead minnows are also found in the river below the lake as far downstream as Glenwood (Propst et al. 2009). There is no impetus to establish live bait populations for use in Luna Lake to pursue stocked trout.

*Verde River***Description of the action area**

The action area is the Verde River stocking sites listed in Table 9 and hydrological connections from those sites to the proposed critical habitat units.

**A. Status of the species and critical habitat within the action area**

Loach minnow were stocked into Fossil Creek above the fish barrier (located approximately 4.5 miles upstream of the confluence with the Verde River in 2007 with augmentations in 2008. The population has yet to become established. Individual loach minnow that are displaced from the stocking reach in Fossil Creek to below the fish barrier are unable to move back upstream and may persist for a time in the proposed critical habitat reach or move into the Verde River.

Critical habitat was proposed for five areas in the Verde River drainage, all of which can be accessed by stocked sportfish to some degree.

**B. Factors affecting the species' environment and critical habitat within the action area**

Land management actions on private and public lands, water diversions, recreation, and other activities have effects to the physical parameters of proposed critical habitat. The presence of fish, amphibians, and crayfish also affects the PBFs for the proposed critical habitat units.

All five proposed critical habitat units contain PBFs 1, 2, 3, and 4, with only Granite not meeting PBF 6 due to the upstream dams that control flows. The ability of any of the proposed reaches to support new PBF 5 at this time is unknown. All the reaches maintain significant populations of nonnative species.

**EFFECTS OF THE ACTION**

Stocking actions in the Verde River affect PBF 5 through the addition of additional potential predators to the system. Sportfish are not stocked into the critical habitat in four cases. For the three stocking sites on Granite Creek (Goldwater, Watson, and Willow Springs), the escapement of bluegill, black crappie, and rainbow trout may occur when these reservoirs spill down Granite Creek (largemouth bass in Goldwater Lake may reach Watson Lake where the species is already established). Escapement rainbow trout from Green Valley Lake downstream to the Verde River then upstream to Fossil Creek may occur after spills from the lake. For all other sites, only rainbow trout would be stocked into the critical habitat reaches.

Bluegill, black crappie, and largemouth bass are established in portions of the Verde River within the proposed critical habitat reaches. The potential for escapement from the Granite Creek stocking sites is limited to periods when the reservoirs spill, and to date, no black crappie have been documented in the upper Verde River and bluegill were documented only once in 1992. Largemouth bass have been found at total of eight times between 1966 and 2005 with 19

individuals recorded, and do not have an established population in the Upper Verde River (see additional discussion on this topic in the spikedace analysis). All species proposed for stocking (except rainbow trout) are already in one or more of the Granite Creek reservoirs (black crappie was known historically from all three but is only currently documented from Watson Lake), and stocking under the proposed action does not increase the potential for these species to reach the Upper Verde River and the proposed critical habitat and does not support any self-sustaining populations of these species in the river. Rainbow trout is established in Oak Creek, but not generally in the other proposed sites and is only found seasonally while it is stocked so its effect is limited to the winter and spring, not the peak spawning season for loach minnow. Use of triploid rainbow trout under the proposed action also prevents stocked fish from supporting the wild populations. Also, stocking of rainbow trout into the Verde River and its tributaries is a continuing action, and is part of the baseline situation for nonnative species in the proposed units. As noted in the proposed rule, PBF 5 is already compromised in the Verde River and its tributaries due to the continuing presence of mosquitofish, red shiners, fathead minnows, green sunfish, smallmouth bass, yellow bullhead, and common carp.

The continuing presence of established populations of these warmwater nonnative species may have significant effects to the conservation potential of these critical habitat units that will be evaluated prior to final designation of critical habitat. Because we expect that there would be very few instances of stocked warmwater sportfish leaving the Watson or Willow lakes, and that those species, while already present in at least one of the two lakes, have not been regularly found or have established a self-sustaining population in the upper Verde River critical habitat unit, we believe that the additive effect of stocked warmwater sportfish accessing the upper Verde River would not significantly increase the numbers or species of nonnative fish present in the system over the period covered by this consultation or and increase predation and/or competition pressures such that the value of the critical habitat for recovery is further compromised.

Loach minnow stocked into Fossil Creek that move downstream of the fish barrier into lower Fossil Creek or the Verde River are at risk of predation from the established fish populations present, and the additive rainbow trout from stocking actions has a minor temporary effect due to the limited number of rainbow trout that may access this portion of the Verde River and the limited time the rainbow trout are present.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide



Analysis discusses this effect in more detail.

Disease and parasites are additional threats to loach minnow populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect loach minnow. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CONCLUSION

After reviewing the current status of loach minnow and its designated and proposed critical habitat on the Black River, San Francisco River, Tularosa River, Negrito Creek, and the Verde River, the environmental baseline for the action area, the effects of the proposed sportfish stocking and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the loach minnow, and is not likely to destroy or adversely modify designated critical habitat for the loach minnow.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.<sup>7</sup>

We present this conclusion on the loach minnow and its critical habitat for the following reasons:

- The size of the loach minnow population in the Black River is low and occupied habitat has not been documented within the stocking reach. The numbers of stocked trout leaving the stocking reach to invade occupied loach minnow habitat is likely to be low over the period covered by this consultation based on available information that shows most stocked trout in the East Fork Black River do not move far from the stocking reach and have a limited persistence due to angler removal and low post-stockling survival, and stocked fish from Big or Crescent Lake are unlikely to move out of those sites during winter flooding due to the placement of the weir. The distances involved for Apache trout or Arctic grayling from Ackre Lake to reach occupied habitat in the East Fork Black

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<sup>7</sup> see December 27, 2004, memo from Acting Director Fish and Wildlife Service

River are such that any effects from that stocking are unlikely to occur.

- The effects to PBFs of critical habitat in the Black River are limited due to the primary stocking of native Apache trout rather than rainbow trout and only triploid rainbow trout which cannot support the recruiting population. While stocking high numbers does affect PBF 3d, this effect would be of short duration due to the practice of stocking trout into pools and not riffles where competition for food with loach minnow could occur, angler removal of stocked trout and low post-stocking survival. The trout would be stocked multiple times over a season, therefore numbers will repeatedly increase and decrease over the season but the effect to PBF 3d is not significant due to the reasons cited above and the recovery value of the unit is not significantly compromised.
- The loach minnow populations that could be affected by stocked trout leaving Luna Lake are more than 26 miles downstream in the mainstem San Francisco River as well on two of its tributaries. While Luna Lake can spill every year, and trout move out of the lake during that time and when water is released for agricultural use in the vicinity of the town of Luna, the number of such fish that likely reach occupied loach minnow habitat is likely to be very low. Further, the use of triploid rainbow trout under the proposed action essentially eliminates the potential for any escaped rainbow trout to support recruitment in the wild trout populations. If that support has been an important factor for these wild trout populations, then the result of the proposed action could reduce nonnative issues of concern to PBFs 9 and 5,
- The effects to PBFs 4 and 3d from escaped trout from Luna Lake are similarly limited in scope. The number of rainbow trout entering critical habitat is not sufficient to reduce the existing conservation value of the critical habitat units for loach minnow or preclude improvements to the value of PBF 4 through removal of other nonnative species. Any effects to PBF 3d would be of short duration and no meaningful change in the forage base for loach minnow would occur.
- The effects to PBFs 9 and 5 in the Verde River proposed critical habitat units is minimal given the temporary nature of the presence of rainbow trout, and the very limited potential for bluegill, black crappie, or channel catfish from the stocking sites to affect extant fish populations in the Verde River. The recovery value of the critical habitat units are not further compromised by this action.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.
- The proposed action contains significant conservation actions to address effects of the action and to improve the baseline status of the species.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by WSFR so that they become binding conditions of any grant or permit issued to AGFD, as appropriate, for the exemption in section 7(o)(2) to apply. WSFR has a continuing duty to regulate the activity covered by this incidental take statement. If WSFR (1) fails to assume and implement the terms and conditions or (2) fails to require AGFD to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, WSFR or AGFD must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Luna Lake: Loach minnow are not found at the stocking site, and for stocked trout to reach occupied loach minnow habitat, they must leave the reservoir and move downstream. This event is expected to be rare, and thus we do not believe it is reasonably certain to occur, thus not meeting the first condition. There are wild rainbow trout in the vicinity of the occupied loach minnow habitats that are likely not supported by trout from Luna Lake. Given the rarity of a Luna Lake trout accessing loach minnow habitat, most of the potential predators or competitors are not related to the proposed

action. We are unable to be reasonably certain that any predation on loach minnow would be the result of the proposed action, thus cannot meet the second condition.

The FWS anticipates individual loach minnow may be taken as a result of this proposed action at the East Fork Black River. The incidental take is expected to be in the form of harassment (competition for food) between loach minnow and stocked trout (Apache and rainbow trout) and harm (predation) from stocked trout preying on small loach minnow. The take will occur in the occupied habitat of loach minnow in East Fork Black River when stocked trout move out of the stocking site located below the occupied habitat.

The FWS anticipates incidental take of loach minnow will be difficult to detect for the following reasons:

- The incidental take can only occur if stocked trout reach occupied loach minnow habitat. The physical conditions needed for either of these events to occur are not likely to be met on a regular basis to allow for documentation of the take.
- Incidental take from predation is difficult to detect due to the rapid decomposition of food items in the stomach of a predator. Because predation is not expected to be a regular occurrence, finding the predator within the limited time window post-predation is highly unlikely.
- Incidental take from harassment is difficult to detect because loach minnow are small and any weakened individuals are not likely to be detected, and, unless the debilitation was serious, would not be obvious to an observer.

The surrogate measure for incidental take is the presence of stocked trout in occupied loach minnow habitat. There are some wild rainbow trout and hybrid Apache trout in the East Fork Black River drainage above the occupied habitats. Stocked trout can usually be distinguished from wild trout by experienced observers, so identification of any trout captured can be accomplished in the field.

Based on past survey data from the occupied habitat of loach minnow in East Fork Black River, we consider the presence of stocked trout to be a rare event in occupied loach minnow habitat, so we anticipate that take of loach minnow would not occur every year. The amount of incidental take will be exceeded if more than 10 stocked trout over the period covered by this consultation are found in occupied loach minnow habitat in East Fork Black River during either the standardized surveys or the post-Big Lake spill surveys as described in the CAMP.

## EFFECT OF THE TAKE

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS (as appropriate)

The following reasonable and prudent measures are necessary and appropriate to minimize take of loach minnow:

1. AGFD shall monitor East Fork Black River to determine if stocked trout are present.
2. AGFD shall monitor incidental take resulting from the proposed action and report to the FWS the findings of that monitoring.

#### TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, WSFR must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Implementation of these terms and conditions is part of the CAMP.

The following term and condition implements reasonable and prudent measure #1 for loach minnow:

1. AGFD shall survey the occupied loach minnow habitat in East Fork Black River during fish community surveys identified in the CAMP in two years during the 10-year period. If any stocked trout are found, these will be documented and removed from the stream and an additional survey to locate stocked trout will be implemented in the following year.

The following term and condition implements reasonable and prudent measure #2 for loach minnow:

1. In years when incidental take monitoring occurs, AGFD shall submit to WSFR a report of that monitoring either with the annual report on implementation of the Conservation and Mitigation Program (Program), or, if there is no Program report scheduled for that year, by the due date normally set for the delivery of the Program report. WSFR will submit the incidental take monitoring report to AESO within the timeline set for reporting on implementation of the Program.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. WSFR, using information provided by AGFD, must immediately provide an explanation of the causes of the taking and review with the AESO the need for possible modification of the reasonable and prudent measures.

#### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202,

telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. In the Conservation and Mitigation Program included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for loach minnow contingent upon Program funding availability as described in the Program document. The ability to implement recovery actions for loach minnow under the auspices of the Program provides conservation benefits to loach minnow that may not be otherwise realized.
2. Participate in efforts to remove nonnative species from the San Francisco River in the proposed action area in Arizona downstream of Luna Lake.
3. Cooperate in efforts to preclude release/escape of trout from the Glenwood Hatchery to further minimize impacts of trout species on loach minnow.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

#### **Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*)**

##### DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the annual stocking of rainbow trout, brown trout, brook trout, and white amur into Riggs Flat Lake as multiple events between April and October. Stocking trucks would access the lake via Swift Trail five times per year based on current protocols.

##### Conservation measures included in the proposed action

Coordinate with the Coronado National Forest on traffic management that can reduce the risk of mortality to Mount Graham red squirrels from vehicles accessing Riggs Flat Lake as part of continuing implementation of the Mount Graham Red Squirrel Recovery Plan.

##### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide or recovery unit)

### *Listing*

The Mount Graham red squirrel (red squirrel) was listed as endangered in 1987 (52 FR 20994) (USFWS 1987b). Critical habitat was designated in 1990 (55 FR 425) (USFWS 1990b). Critical habitat occurs in three areas in the Pinaleno Mountains (Hawk Peak/Mount Graham, Webb Peak, and Heliograph Peak) and covers a total of about 2,000 acres. The only identified constituent element was dense spruce-fir forest. The Mount Graham Red Squirrel Recovery Plan was signed in 1993 (USFWS 1993b) and is currently under revision.

### *Critical habitat*

On January 5, 1990, the USFWS designated critical habitat for the red squirrel (55 FR 425-429). Critical habitat includes three areas: the area above 10,000 feet in elevation surrounding Hawk and Plain View peaks and a portion of the area above 9,800 feet; the north-facing slopes of Heliograph Peak above 9,200 feet; and the east-facing slope of Webb Peak above 9,700 feet. The main attribute of these areas at that time was the existing dense stands of mature (about 300 years) spruce-fir forest. The Mount Graham Red Squirrel Refugium established by the AICA has the same boundary as the designated critical habitat boundary surrounding Hawk and Plain View peaks (about 1,700 acres), but does not include critical habitat on Heliograph or Webb Peaks. Unfortunately, most of the habitat in the refugium and in CH has been devastated by wildfire and insect damage. There remains a small, unknown amount of habitat in the Refugium (A. Casey, personal communication).

Swift Trail, the access road to Riggs Lake, does not pass through the area designated as critical habitat. Riggs Lake, and the immediate vicinity, is not located within designated critical habitat for the red squirrel. There are no effects to critical habitat from the proposed action, and critical habitat will not be considered further in this BO.

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the Mt. Graham red squirrel (red squirrel). This information was taken from the most recent biological opinion written for the red squirrel (USFWS 2008g) addressed the continuation of summer home permits at Columbine and Turkey Flat and contains the most up-to-date status of the species. The 5-year review (USFWS 2008h) also contains additional information. Information in these documents is incorporated by reference.

### *Life history*

Red squirrels are small arboreal rodents that live in conifer forests. Breeding takes place in the spring and the nest is usually in a hollow snag, tree hollow, downed log, or other sites that can provide a sheltered canopy. The usual is one litter of two to eight young, although two litters in one season has been reported.

Foods of the red squirrel include the seeds of Englemann spruce and Douglas fir, which are cached in middens for winter storage. Mushrooms are also important seasonally and some may

be stored in the midden. Other seasonal foods such as berries, bark cambium, pistillate cones (pollen), and other types of seeds. Between nine and twelve mature trees are sufficient to support one adult and these form the core of the home range.

#### Habitat use

Red squirrels are territorial and one squirrel per territory is the norm. Young leave the mother's territory to establish their own. Mixed-conifer and spruce-fir communities provide shelter, a food base, and moist conditions needed to maintain middens for winter food storage. Territory sites are in patches of forest that are generally denser in foliage volume and canopy cover than adjoining areas. Downed logs, snags and other structure is important for midden placement and nest sites.

#### Current distribution

The red squirrel is only known from the Pinaleño Mountains on the Coronado National Forest. The current number of known middens, which includes those that are active, inactive, and abandoned, is 1288. Areas that support middens continue to do so if habitat parameters remain suitable although old middens may be abandoned and new ones developed. The population has been estimated since 1986 with estimates ranging from 99 to 562 squirrels; there is no statistical evidence suggesting a rise or decline in the population from these estimates (T. Snow pers.comm.). The fall 2009 survey estimated the population at 250 (+/- 11) squirrels.

#### Threats

Threats facing red squirrels include predation, loss of habitat due to native and exotic insect infestations (Koprowski et al. 2005), direct mortality and loss of habitat and middens due to large-scale wildfires (Koprowski et al. 2006), loss of habitat due to human factors (e.g., disturbance, conversion to roads, trails, and/or recreation sites, permitted special uses, etc.; USFWS 1993), loss or reduction of food sources due to drought, and apparent dietary and territory competition with Abert's squirrel, which were introduced in the 1940s by the AGFD (Edelman et al. 2005). The loss of significant areas of habitat to the Clark Peak and Nuttall-Gibson wildfires and insect infestation has reduced the available habitat area and thus increases the value of the remaining habitats.

Population declines in the spruce-fir forest corresponded with a period of insect damage and wildfires that began in 1996 and had devastated that forest type by 2002. Koprowski et al. (2005) characterized the decline of the red squirrel in their study area as catastrophic. They note that in areas of high tree mortality in Alaska and Colorado, red squirrels did not completely disappear but rather persisted in residual stands of trees where conditions remained suitable. The ability of the red squirrel to survive the current catastrophic decline is unknown; however, it apparently survived a similar situation in the late 1600s. Grissino-Mayer et al. (1995) sampled fire-scarred trees in four areas of the Pinaleño Mountains from Peter's Flat east to Mt. Graham. The oldest trees in the spruce-fir forest were about 300 years old. They found evidence for a widespread, stand-replacing fire in 1685 that probably eliminated much of the forest atop the Pinaleños. Although the red squirrel population persisted through that event and may persist



through the current catastrophic event, small populations can exhibit genetic or demographic problems that further compromise the ability of the subspecies to survive. Low genetic variability in small populations is a concern because deleterious alleles are expressed more frequently, disease resistance might be compromised, and there is little capacity for evolutionary change in response to environmental change. Koprowski et al. (2005) recommended management actions to increase available habitat and population size in the near and distant future.

Vehicle-related mortality was identified as a threat to red squirrels in the 1988 BO on the Coronado National Forest Plan and Mount Graham Astrophysical Area Plan (USFWS 1988). Incidental take for up to six red squirrels a year was provided in that BO; four from traffic on roads and two middens from increased recreational activity and astrophysical development.

#### Conservation actions

Conservation actions for the red squirrel were identified in the 1988 BO (USFWS 1988), and the 2008 Mt. Graham summer homes BO (USFWS 2008g). In addition, multi-agency surveys of red squirrels are conducted in the fall to document population size and trends. A captive breeding program was also recommended, the concept of which has been endorsed by the Mount Graham Red Squirrel Recovery Team. Until recently, funding has not been available to implement captive propagation.

#### *Previous consultations*

Section 7 consultations on red squirrels include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (particularly recreation, wildfire suppression and post-fire restoration, and astrophysical site development). Biological opinions on actions potentially affecting red squirrel may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

The action area is defined as the area within which effects to the listed species and its critical habitat (if any is designated) are likely to occur and is not limited to the actual footprint of the proposed action. For this consultation, the action area is defined by Swift Trail from the start of occupied red squirrel habitat to Riggs Lake, Riggs Lake and its shoreline and the recreational development at the lake, and the hiking trails that originate at the lake. The entire distance of Swift Trail in red squirrel habitat is included since anglers pursuing stocked sportfish and the

stocking trucks must use the entire length of the road to reach the stocking site.

#### **A. Status of the species and critical habitat within the action area**

Red squirrels occupy the area along Swift Trail to the vicinity of the lake. Middens are known on the slopes of Merrill Peak beginning about 0.25 miles southeast of the lake, with 44 middens documented in the vicinity. This is a small sub-set of the 1,288 middens currently known. The 1996 Clark Peak fire, started due to undetermined human causes, began in the area south of Riggs Flat Lake and initially spread north and east towards Merrill Peak and continued east, north and south, crossing north of Swift Trail in several places. Swift Trail was used as a fire line east of the Riggs Flat recreation site. The red squirrel habitat around Riggs Flat Lake and the west and north of Merrill Peak did not burn in the fire. There is no critical habitat in the vicinity of Riggs Flat Lake or on Swift Trail itself.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

The action area contains an existing road, man-made lake, and recreational developments. These features were completed prior to the listing of the red squirrel as an endangered species. Presence of the road fragments red squirrel habitat and reduces microclimates along the road edge that may reduce suitability for middens. The open meadow at the lake is constrained from development into forest by the presence of the lake and the recreational facilities. Edge effect from this opening results in dryer conditions for some distance into the adjoining forest which may reduce suitability for middens. No formal study has been conducted on edge effects of trails and roads on midden persistence.

Recreationists utilizing the area include picnickers, campers, hikers and anglers with some recreationists engaged in multiple activities while in the action area. The Coronado National Forest manages the Riggs Flat Lake recreation site and imposes limits on occupancy, fire restrictions when appropriate, and provides sanitary facilities and trash removal. While present, recreationists may collect dead and down wood for campfires, hike along trails or up the slopes of Merrill Peak where red squirrel middens exist. Under the terms of the 1988 BO on the Land Management Plan, the Forest Service was charged with identifying and implementing measures to reduce the risk of road kill of red squirrels (signs, speed bumps). There are several middens near the road immediately before Riggs Flat Lake. Speed limit signs are posted along Swift Trail to control road speeds.

Current use of Swift Trail is limited to administrative access for Forest Service personnel, Mount Graham International Observatory personnel, and Arizona Department of Transportation personnel during the winter months (November 15 through April 15 yearly), in accordance with the Arizona-Idaho Conservation Act of 1988 (AICA). During the summer months, this mountain range provides a popular place for recreating to avoid lower elevation heat. However, despite this popularity, traffic remains low; average daily traffic counts from years 2003, 2004, and 2005 show 60, 90, and 100 vehicles per day, respectively. Since the Mount Graham red squirrel was listed as endangered in 1987, a total of eight road-killed squirrels have been reported, with two being the most reported in any one year (both 1989 and 2004) (USFWS, personal comment 2008). However, the total number of red squirrels killed on the road is likely greater due to

irregular monitoring and the rapidity at which dead animals are removed from the road by scavengers.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Middens are known from along Swift Trail leading to the lake and on the slopes of Merrill Peak beginning about 0.25 miles southeast of the lake, with 44 middens documented in the vicinity. Riggs Lake is a popular recreation site with an existing developed campground as well as a boat launch ramp. Human developments in red squirrel habitats are considered threats because human use of the sites can have direct effects related to removal of vegetation, which could result in decreased food sources, potential increase of tree blow-down, changes in microhabitat, and increased vulnerability to predation. There is no plan to extend the existing recreational facilities at Riggs Lake, so significant future vegetation removal is not likely to occur. Continued use of the existing recreational facilities maintains risks to red squirrel habitat from potential forest fires, vehicle related mortality of red squirrels, and collection of dead and down wood that may affect midden structure. Dead and down wood in middens is generally old and covered with spruce and fir cone scales which make it damp and unsuitable for campfires.

The presence of recreationists may result in the disturbance of red squirrels at their middens or while foraging. A considerable portion of occupied red squirrel habitat was closed to all recreational entry as an off-setting measure for the increased human presence during the construction and operation of the Mt. Graham International Observatory on Emerald Peak. Red squirrels are present at or near existing summer home developments, campgrounds and along Swift Trail in the Pinaleno Mountains (USFWS 2008g) and have maintained use of these areas despite close human presence. Riggs Lake is a popular recreation site for camping, picnicking, and hiking as well as the angler use. The annual fall survey of a random selection of known middens provides information on the red squirrels in the vicinity of Riggs Lake. Red squirrels continue to use this area with evidence of normal cycling between active and inactive sites as occurs in other areas of the mountains. No particular effects to these red squirrels due to human presence have been documented through the surveys. Most of the recreational use around Riggs Lake is around the lake and developed facilities. There may be some hiking up the steep slopes of Merrill Peak; however, the existing trails from the lake area do not go toward the midden area on the slopes. General angler activities (e.g. fishing, boating or canoeing, and hiking around the shoreline) would not likely effect red squirrels (T. Snow pers. comm.) since the red squirrels are not likely to use the open areas surrounding the lake. The amount of disturbance to foraging red squirrels from anglers hiking away from the lake is likely to be a small component of the total amount of potential disturbance.

Vehicle and human noise, depending on levels and proximity to a midden site, may be disruptive to red squirrels, particularly during their breeding season. If noise arouses an animal, it has the potential to affect its metabolic rate by making it more active. Increased activity can, in turn, deplete energy reserves (Bowles 1995). This may be a temporary or occasional disruption. Species that are sensitive to the presence of people may be displaced permanently, which may be more detrimental to wildlife than recreation-induced habitat changes (Gutzwiller 1995, Knight and Cole 1995). If animals are denied access to areas that are essential for reproduction and survival, that population will most likely decline. Likewise, if animals are disturbed while performing behaviors such as foraging or breeding, that population will also likely decline (Knight and Cole 1995). As noted in the preceding paragraph, anglers at the lake are unlikely to disturb red squirrels except if they move away from the lake.

There is some risk of disturbance to foraging red squirrels with middens near the road and mortality to red squirrels from vehicles accessing Riggs Flat Lake via Swift Trail. There are eight documented reports of red squirrels killed by cars or trucks; but the opportunity to document such kills is limited to cases where the carcass is immediately reported.

In 2010, five stocking actions are proposed by AGFD; four in April and May and one in September. We assume this pattern is likely to continue through the 10-year period of the proposed action. The number of anglers accessing the lake is a subset of the total recreation use. AGFD identified 6,568 angler use days at Riggs Flat Lake in 2001 (Pringle 2004). The number of angler use days is not likely a major component of the total recreational use, angler trips represent an unknown and maybe substantial proportion of the total use of the road in the vicinity of Riggs Lake.

Angler and stocking truck access to Riggs Lake occurs throughout the red squirrel breeding and food-storage activity seasons. Home-range sizes of Mount Graham red squirrels (in which they spend 95 percent of their time) are three to ten times greater than reported for other populations of red squirrels (Koprowski et al. 2008), annually averaging 5.9 acres for females and 24.5 acres for males (Koprowski, draft MGRS Recovery Team Meeting Minutes, March 16, 2006). If an adult red squirrel occupies a midden territory near the road, it could be vulnerable to road kill. Dispersing young are also vulnerable to road kill while they search for new or unoccupied midden sites. The existing amount of recreational activity at facilities at Riggs Flat Lake has not obviously constrained red squirrel foraging as evinced through population surveys.

The risk of wildfire due to recreationists is a concern for red squirrel habitats along Swift Trail and at the lake. Forest Service management addresses use of fires at Riggs Flat Lake and along Swift Trail; however, wildfire is always a potential risk due to human or natural causes, particularly during periods of drought or after insect infestations have killed trees.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The action area is entirely managed by the Coronado National Forest. Future actions related to upgrades to Swift Trail have been identified, and would require section 7 consultations either through Forest Service permitting processes or Federal Highway Administration funding.

## CONCLUSION

After reviewing the current status of the Mount Graham red squirrel, the environmental baseline for the action area, the effects of the proposed stocking of sportfish at Riggs Flat Lake and the cumulative effects, it is the AESO's biological opinion that the stocking action, as proposed, is not likely to jeopardize the continued existence of the Mt. Graham red squirrel. Critical habitat for this species has been designated at other sites in the Pinaleño Mountains; however, this action does not affect those areas and no destruction or adverse modification of that critical habitat is anticipated.

We present this conclusion on the Mount Graham red squirrel for the following reasons:

- Stocking truck and angler access related to the proposed action is a portion of the existing estimated road traffic on Swift Trail. This amount of road traffic was documented and discussed in extant BOs (USFWS 1988 and 2008f) as a level not likely to jeopardize the red squirrel. Only eight red squirrels have been documented as road kills since the subspecies was listed in 1987. The conservation measure included in the proposed action for AGFD to work with the Coronado National Forest on traffic management provides conservation benefit for the species related to the potential adverse effect.
- Red squirrel numbers in the vicinity of Riggs Flat Lake do not appear, based on annual fall surveys, to be adversely affected by the presence of recreationists, including anglers, at the recreation site.
- The risk of human-caused wildfire related to stocking truck or angler access or the actions of anglers while at Riggs Flat Lake is of concern. However, Forest Service management of the recreational site contains measures to reduce the risk of human-caused wildfires originating at the site. The one wildfire in the vicinity of the lake was started by an undefined human cause in a steep area south of the lake and off an established trail.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is defined (50 CFR 17.3) to include significant habitat

modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### **AMOUNT OR EXTENT OF TAKE**

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- **Riggs Flat Lake:** Red squirrels are present in the forests around the lake and along the access road. Since the take is related to vehicle mortality, the first condition is met. Vehicle-related mortality of red squirrels was identified in the 1988 BO to the Coronado National Forest (USFWS 1988), and incidental take for up to six red squirrels per year (four from traffic on roads and two from disturbance at middens) was provided. The amount of vehicle-related incidental take was not separated by types of traffic using the roads, so any take due to anglers accessing Riggs Flat Lake was included in that take statement, as the stocking program at the lake was in existence in 1988. The proposed action for this consultation does not result in any additional incidental take over that provided in 1988. For the second condition, locating a road-killed red squirrel does not, unless reported by the driver of the vehicle, identify the type of recreation the driver proposed to engage in on the forest. Under these conditions, determining if we are reasonably certain that the proposed action resulted in the take is problematical, and meeting the second condition unlikely. However, because the incidental take is already accounted for under the 1988 BO, the inability to meet the second condition and include a take statement for this consultation does not result in take being under estimated.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We recommend that AGFD continue to be an active participant in monitoring and recovery implementation for the red squirrel.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### **Razorback sucker (*Xyrauchen texanus*) and critical habitat**

#### **DESCRIPTION OF THE PROPOSED ACTION**

Razorback suckers are in proximity to stocking sites on the lower Colorado River, lower Gila River, and Verde River (Table 13). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. All populations are reintroduced, but are fully protected under the ESA.

Table 13: Stocking sites, sportfish species proposed for stocking, and potentially affected razorback sucker populations and critical habitat units.

| <b>Stocking complex/site</b> | <b>Species proposed for stocking</b> | <b>Razorback population affected</b> | <b>Critical habitat unit</b>     |
|------------------------------|--------------------------------------|--------------------------------------|----------------------------------|
| <i>Lower Gila River</i>      |                                      |                                      |                                  |
| Fortuna Pond                 | ONMY, LEMA, MISA, ICPU               | Lower Colorado River                 | None                             |
| Redondo Lake                 | ONMY, LEMA, MISA, ICPU               | Lower Colorado Rive                  | None                             |
| Wellton Golf Course*         | ONMY, LEMA, MISA, ICPU               | Lower Colorado Rive                  | None                             |
| <i>Lower Colorado River</i>  |                                      |                                      |                                  |
| La Paz County Park Lagoon    | ONMY, LEMA, ICPU                     | Lower Colorado Rive                  | Parker Dam to Imperial Reservoir |
| La Paz County Park Pond      | ONMY, LEMA, ICPU                     | Lower Colorado River                 | Parker Dam to Imperial Reservoir |
| Hidden Shores Golf Course*   | ONMY, LEMA, MISA, ICPU               | Lower Colorado Rive                  | Parker Dam to Imperial Reservoir |
| Yuma West Wetlands Pond      | ONMY, LEMA, MISA, ICPU               | Lower Colorado Rive                  | None                             |
| <i>Verde River</i>           |                                      |                                      |                                  |
| Middle Verde River           | ONMY                                 | Middle/Lower Verde                   | Perkinsville to Horseshoe Dam    |
| Oak Creek                    | ONMY                                 | Middle/Lower Verde                   | Perkinsville to Horseshoe Dam    |
| Wet Beaver Creek             | ONMY                                 | Middle/Lower Verde                   | Perkinsville to Horseshoe Dam    |

|                   |      |                    |                               |
|-------------------|------|--------------------|-------------------------------|
| West Clear Creek  | ONMY | Middle/Lower Verde | Perkinsville to Horseshoe Dam |
| Green Valley Lake | ONMY | Middle/Lower Verde | Perkinsville to Horseshoe Dam |

Conservation measures included in the proposed action

A barrier net shall be installed at the La Paz County Park Lagoon immediately prior to the stocking event and remain in place for seven days after the stocking event.

STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

*Listing*

The razorback sucker (*Xyrauchen texanus*) was first proposed for listing under the Endangered Species Act (Act) on April 24, 1978, as a threatened species. The proposed rule was withdrawn on May 27, 1980, due to changes to the listing process included in the 1978 amendments to the Act. In March 1989, the Fish and Wildlife Service was petitioned by a consortium of environmental groups to list the razorback sucker as an endangered species. The Fish and Wildlife Service made a positive finding on the petition in June 1989, which was published in the Federal Register on August 15, 1989. The finding stated that a status review was in progress and provided for submission of additional information through December 15, 1989.

The proposed rule to list the species as endangered was published on May 22, 1990, and the final rule published on October 23, 1991, with an effective date of November 22, 1991. The Razorback Sucker Recovery Plan was released in 1998 (USFWS 1998c). Recovery Goals were approved in 2002 (USFWS 2002e).

Critical habitat was designated in 15 river reaches in the historical range of the razorback sucker on March 21, 1994, with an effective date of April 20, 1994 (USFWS 1994b). Critical habitat included portions of the Colorado, Duchesne, Green, Gunnison, San Juan, White, and Yampa rivers in the Upper Colorado River Basin, and the Colorado, Gila, Salt, and Verde rivers in the Lower Colorado River Basin.

*Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the razorback sucker. This information was taken from the 2002 Recovery Goals (USFWS 2002e), and the Lower Colorado River Multi-Species Conservation Program Species Status documents (LCR MSCP 2005). Information in these documents is incorporated by reference.

*Life history*

The razorback sucker is the only representative of the genus *Xyrauchen* and was described from specimens taken from the “Colorado and New Rivers” (Abbott 1861) and Gila River (Kirsch



1889) in Arizona. This native sucker is distinguished from all others by the sharp-edged, bony keel that rises abruptly behind the head. The body is robust with a short and deep caudal peduncle (Bestgen 1990). The razorback sucker may reach lengths of 3.3 feet and weigh 11 to 13 pounds (Minckley 1973). Adult fish in Lake Mohave reached about half this maximum size and weight (Minckley 1983). Razorback suckers are long-lived, reaching the age of at least the mid-40's (McCarthy and Minckley 1987).

The razorback sucker is adapted to widely fluctuating physical environments characteristic of rivers in the pre-Euro-American-settlement Colorado River Basin. Adults can live 45-50 years and, once reaching maturity between two and seven years of age (Minckley 1983), apparently produce viable gametes even when quite old. The ability of razorback suckers to spawn in a variety of habitats, flows, and over a long season are also survival adaptations. In the event of several consecutive years with little or no recruitment, the demographics of the population might shift, but future reproduction would not be compromised. Average fecundity recorded in studies ranges from 46,740-100,800 eggs per female (Bestgen 1990). With a varying age of maturity and the fecundity of the species, it would be possible to quickly repopulate an area after a catastrophic loss of adults.

Spawning takes place in the late winter to early summer depending upon local water temperatures. Various studies have presented a range of water temperatures at which spawning occurs. In general, temperatures from 10° to 20° C are appropriate (summarized in Bestgen 1990). They typically spawn over cobble substrates near shore in water 3-10 feet deep (Minckley et al. 1991). There is an increased use of higher velocity waters in the spring, although this is countered by the movements into the warmer, shallower backwaters and inundated bottomlands in early summer (McAda and Wydoski 1980, Tyus and Karp 1989, Osmundson and Kaeding 1989). Spawning habitat is most commonly over mixed cobble and gravel bars on or adjacent to riffles (Minckley et al. 1991).

Razorback sucker diet varies depending on life stage, habitat, and food availability. Larvae feed mostly on phytoplankton and small zooplankton and, in riverine environments, on midge larvae. Diet of adults taken from riverine habitats consisted chiefly of immature mayflies, caddisflies, and midges, along with algae, detritus, and inorganic material (USFWS 1998c).

#### Habitat use

Adult razorback suckers use most of the available riverine habitats, although there may be an avoidance of whitewater type habitats. Main channel habitats used tend to be low velocity ones such as pools, eddies, nearshore runs, and channels associated with sand or gravel bars (Bestgen 1990). Adjacent to the main channel, backwaters, oxbows, sloughs, and flooded bottomlands are also used by this species. From studies conducted in the upper Colorado River basin, habitat selection by adult razorback suckers changes seasonally. They move into pools and slow eddies from November through April, runs and pools from July through October, runs and backwaters during May, and backwaters, eddies, and flooded gravel pits during June. In early spring, adults move into flooded bottomlands. They use relatively shallow water (ca. three feet) during spring, and deeper water (five to six feet) during winter.

Data from radio-telemetered razorback suckers in the Verde River showed they used shallower depths and slower velocities than in the upper basin. They avoided depths <1.3 feet, but selected depths between 2.0 and 3.9 feet, which likely reflected a reduced availability of deeper waters compared to the larger upper basin rivers. However, use of slower velocities (mean = 0.1 foot/sec) may have been an influence of rearing in hatchery ponds. Similar to the upper basin, razorback suckers were found most often in pools or run over silt substrates, and avoided substrates of larger material (Clarkson et al. 1993).

Razorback suckers also use reservoir habitat, where the adults may survive for many years. In reservoirs, they use all habitat types, but prefer backwaters and the main impoundment (USFWS 1998c). Much of the information on spawning behavior and habitat comes from fishes in reservoirs where observations can readily be made. Habitat needs of larval and juvenile razorback sucker are reasonably well known. In reservoirs, larvae are found in shallow backwater coves or inlets (USFWS 1998c). In riverine habitats, captures have occurred in backwaters, creek mouths, and wetlands. These environments provide quiet, warm water where there is a potential for increased food availability. During higher flows, flooded bottomland and tributary mouths may provide these types of habitats.

Razorback suckers are somewhat sedentary; however, considerable movement over a year has been noted in several studies (USFWS 1998c). Spawning migrations have been observed or inferred in several locales (Jordan 1891, Minckley 1973, Osmundson and Kaeding 1989, Bestgen 1990, Tyus and Karp 1990). During the spring spawning season, razorbacks may travel long distances in both lacustrine and riverine environments, and exhibit some fidelity to specific spawning areas (USFWS 1998c). In the Verde River, radio-tagged and stocked razorback suckers tend to move downstream after release. Larger fish did not move as much from the stocking site as did smaller fish (Clarkson et al. 1993).

#### Current distribution

The razorback sucker was once abundant in the Colorado River and its major tributaries throughout the Basin, occupying 3,500 miles of river in the United States and Mexico (Maddux et al. 1993). Records from the late 1800's and early 1900's indicated the species was abundant in the lower Colorado and Gila rivers drainages (Kirsch 1889, Gilbert and Scofield 1898, Minckley 1983, Bestgen 1990). It now occurs in portions of the upper Colorado, Duchesne, Green, Gunnison, White, and Yampa rivers in the Upper Basin and in the lower Colorado River from Grand Canyon down to Imperial Dam and in the Verde River.

#### Threats

Since the arrival of Euro-Americans in the southwest, the range and abundance of razorback sucker has been devastated by water manipulations, habitat degradation, and importation and invasion of nonnative species. Construction of dams, reservoirs, and diversions destroyed, altered, and fragmented habitats needed by the sucker. Channel modifications reduced habitat diversity, and degradation of riparian and upland areas altered stream morphology and hydrology. Finally, invasion of these degraded habitats by a host of nonnative predacious and competitive species has created a hostile environment for razorback sucker larvae and juveniles.

Although the suckers bring off large spawns each year and produce viable young, the larvae are largely eaten by the nonnative fish species (Minckley et al. 1991).

#### Conservation actions

The range-wide trend for the razorback sucker is a continued decrease in wild populations due to a lack of sufficient recruitment and the loss of old adults due to natural mortality. Stocking and other recovery efforts by the Upper Colorado River Basin Recovery Implementation Program are ongoing and information on those actions is available at their website. The Lower Colorado River Multi-Species Conservation Program is also implementing conservation actions for the species that are described on their website.

Since 1997, significant new information on recruitment to the wild razorback sucker population in Lake Mead has been developed (Albrecht et al. 2008) that indicates some degree of successful recruitment is occurring. This degree of recruitment has not been documented elsewhere in the species remaining populations.

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the razorback sucker recovery plan. In the Lower Colorado River Basin, efforts to reintroduce the species to the Gila, Salt, and Verde rivers have not been successful in establishing self-sustaining populations. Reintroduction efforts continue in the Verde River. Very few razorback suckers were recaptured from these efforts (Jahrke and Clark 1999). The Horseshoe-Bartlett HCP (SRP 2008) contains conservation actions to be implemented in the Verde River for the razorback sucker, including funding for continued stocking of the species.

#### *Critical Habitat*

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species’ eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (see p. 4-34, U.S. Fish and Wildlife

Service and National Marine Fisheries Service 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

Critical habitat for the razorback sucker includes 15 river reaches in six states (Table 14). Five of these reaches were identified as essential for downlisting, with the remaining 10 essential for delisting.

Recovery for the razorback sucker is currently defined by the FWS Razorback Sucker Recovery Goals (USFWS 2002e). The Recovery Goals define recovery as specific demographic goals that must be attained, and recovery factors that must be met to achieve downlisting and delisting of razorback sucker. The recovery factors were derived from the five listing threat factors and state the conditions under which threats are minimized or removed sufficient to achieve recovery; a list of site-specific management actions and tasks is also provided to assist in meeting recovery factors. The management actions and tasks consist of specific actions (e.g. the development and implementation of nonnative fish control programs). They also include the need to identify, implement, evaluate, and revise (as necessary through adaptive management) flow regimes to benefit razorback sucker for all the rivers in which the species occurs. Essentially, the goals identify actions (management actions and tasks and associated recovery factor criteria) needed to maintain the habitat features (i.e. the PBFs of critical habitat) to accomplish recovery. But the measure of whether or not actions are working with regard to recovery, and the basis for altering management actions through adaptive management, are the demographic criteria. The site-specific management actions and tasks and recovery actions, as well as the demographic Recovery Goals, are provided in USFWS (2002e). We summarize here the Recovery Goal demographic criteria for downlisting as follows (population demographics in both recovery units must be met in order to achieve downlisting):

#### Upper basin recovery unit

- Green River Subbasin
  1. A self-sustaining population is maintained over a 5-year period, starting with the first point estimate acceptable to the Service, such that:
    - a. the trend in adult (age 4+;  $\geq 400$  mm TL) point estimates does not decline significantly, and
    - b. mean estimated recruitment of age-3 (300-400 mm TL) naturally produced fish equals or exceeds adult mortality, and
    - c. each population point estimate exceeds 5,800 adults (Note: 5,800 is the estimated MVP number).
- Upper Colorado River and San Juan River Subbasins
  1. A self-sustaining population is maintained in EITHER the upper Colorado River subbasin or the San Juan River subbasin over a 5-year period, starting with the first point estimate acceptable to the Service, such that for either population:

- a. the trend in adult (age 4+;  $\geq 400$  mm TL) point estimates does not decline significantly, and
- b. mean estimated recruitment of age-3 (300-400 mm TL) naturally produced fish equals or exceeds adult mortality, and
- c. each point estimate exceeds 5,800 adults (MVP).

Lower basin recovery unit

- Lake Mohave
  1. Genetic variability of razorback sucker in Lake Mohave is identified, and a genetic refuge is maintained over a 5-year period.
- Rest of basin
  1. Two self-sustaining populations (e.g., mainstem and/or tributaries) are maintained over a 5-year period, starting with the first point estimate acceptable to the Service, such that for each population:
    - a. the trend in adult (age 4+;  $\geq 400$  mm TL) point estimates does not decline significantly, and
    - b. mean estimated recruitment of age-3 (300-400 mm TL) naturally produced fish equals or exceeds adult mortality, and
    - c. each point estimate exceeds 5,800 adults (MVP).

The biological support document (Maddux et al. 1993) discusses in depth how each reach contributes to the physical and biological factors (PBFs). The PBFs are:

- Water- This includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminations, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage.
- Physical habitat- this includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning, nursery, feeding, rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which, when inundated, provide spawning, nursery, feeding, and rearing habitats.
- Biological environment- Food supply, predation, and competition are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, may be out of balance due to introduced fish species in some areas. This may also be true of competition, particularly from nonnative fish species.

Table 14: Critical habitat units for razorback sucker

| State | Reach<br>Description/<br>River | Reach<br>Description/<br>Segment | Conservation<br>value | Important<br>issues for PBFs<br>at time of<br>designation |
|-------|--------------------------------|----------------------------------|-----------------------|-----------------------------------------------------------|
|-------|--------------------------------|----------------------------------|-----------------------|-----------------------------------------------------------|

|                    |                |                                         |             |                                     |
|--------------------|----------------|-----------------------------------------|-------------|-------------------------------------|
| Arizona/Nevada     | Colorado River | Paria River to Hoover Dam               | Delisting   | Flow alterations, nonnative species |
| Arizona/Nevada     | Colorado River | Hoover Dam to Davis Dam                 | Downlisting | Flow alterations, nonnative species |
| Arizona/California | Colorado River | Parker Dam to Imperial Dam              | Delisting   | Flow alterations, nonnative species |
| Arizona            | Gila River     | New Mexico state line to Coolidge Dam   | Delisting   | Flow alterations, nonnative species |
| Arizona            | Salt River     | Bridge to Roosevelt Dam                 | Delisting   | Flow alterations, nonnative species |
| Arizona            | Verde River    | Perkinsville to Horseshoe Dam           | Delisting   | Flow alterations, nonnative species |
| Colorado           | Colorado River | Rifle to Westwater                      | Downlisting | Flow alterations                    |
| Colorado           | Gunnison River | Uncompahgre River to Redlands Diversion | Delisting   | Flow alterations, nonnative species |
| Colorado           | Yampa River    | Lily Park to Green River                | Downlisting | Nonnative species                   |
| New Mexico/Utah    | San Juan River | Hogback Diversion to Neskahai Canyon    | Downlisting | Nonnative species                   |
| Utah               | Colorado River | Westwater to Dirty Devil                | Delisting   | Nonnative species                   |
|                    | Duchesne River | Lower 2.5 miles                         | Delisting   | Flow alterations, nonnative species |
|                    | Green River    | Yampa River to Sand Wash                | Downlisting | Flow alterations, nonnative species |

|  |             |                             |           |                                     |
|--|-------------|-----------------------------|-----------|-------------------------------------|
|  | Green River | Sand Wash to Colorado River | Delisting | Flow alterations, nonnative species |
|  | White River | Lower 18 miles              | Delisting | Flow alterations, nonnative species |

### *Previous consultations*

Section 7 consultations on razorback sucker include consultations on large-scale water management activities. The Upper Colorado Basin Recovery Program addresses the effects of such consultations on the species and provides conservation to offset the effects. In the lower Colorado River, the Lower Colorado River Multi-Species Conservation Program addresses effects of water management and provides conservation to offset effects. Smaller site-specific consultations address channelization, recreational development, and implementing recovery actions. Biological opinions on actions potentially affecting razorback sucker in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Because of the disjunct nature of the stocking sites where there may be adverse effects to razorback sucker, there are three action areas for consideration. These areas were determined based on the connectivity between stocking sites in the drainages and the locations of the particular stocking sites relative to occupied razorback sucker habitats.

### *Colorado River*

#### **Description of the action area**

The action area is that portion of the lower Colorado River from Parker Dam to and including the confluence with the lower Gila River located below Laguna Dam and the lower Gila River upstream to Fortuna Pond

#### **A. Status of the species and critical habitat within the action area**

Razorback suckers are found in the Colorado River between Parker Dam and Imperial Dam, and critical habitat is designated in the Colorado River and its 100-year flood plain from Parker Dam

to Imperial including Imperial Reservoir to the full pool elevation or 100-year flood plain, whichever is greater. Razorback suckers can access and be present in the La Paz County Park backwater at the time of sport fish stocking.

Razorback suckers have been stocked into the Parker Strip in the past, and are currently stocked by the LCR MSCP into the Parker Strip (Table 15). This activity is expected to continue for the foreseeable future. Monitoring of the stocked fish also occurs under the LCR MSCP (Schooley et al. 2008). Survival of at least some of the stocked razorback suckers has been documented (Schooley et al. 2008), and others have noted the initiation of potential spawning aggregations below Parker Dam (Burke 2009).

Table 15: Razorback sucker stockings in the Parker Strip 2006-2009 (LCR MSCP 2009a)

| Location               | Date  | Number |
|------------------------|-------|--------|
| Buckskin Mountain Park | 9/06  | 1655   |
| Buckskin Mountain Park | 2/07  | 1051   |
| River Island Park      | 11/06 | 2529   |
| River Island Park      | 1/07  | 1924   |
| River Island Park      | 3/07  | 570    |
| River Island Park      | 9/07  | 901    |
| River Island Park      | 9/07  | 2657   |
| River Island Park      | 2/08  | 3024   |
| River Island Park      | 1/09  | 4454   |
| River Island Park      | 3/09  | 1303   |

At the time of designation, the critical habitat reach below Parker Dam supported several constituent elements as described below:

**Water:** Flows are completely controlled by Parker Dam; however, water management with rising spring flows does provide for inundation of shallow water habitats that may be useful for spawning and nursery areas. Water quality is good throughout the reach.

**Physical habitat:** This reach provides a variety of habitats for all life stages of the razorback sucker.

**Biological environment:** Productivity of the reach is sufficient to provide adequate food resources for razorback suckers of all life stages. The robust populations of nonnative fish are a significant concern and were identified as being out of balance in the designation.

Additional selection criteria besides the primary constituent elements were developed to assist in selecting critical habitat areas for the razorback sucker:

**Presence of spawning population:** A small spawning population of razorback suckers was believed to inhabit the reach at the time of designation.



Nursery habitat: Nursery habitat is available in the reach, particularly in the vicinity of Headgate Rock Dam and the Colorado River Indian Reservation (CRIT) canals.

Historical or present distribution: This is known habitat for the razorback sucker, with some of the earliest records from the lower Colorado River coming from this reach. It was considered occupied at the time of designation.

Maintenance of rangewide distribution: This is the lowest elevation river in the range of the species that still maintains permanent water.

Special management: Large numbers of nonnative fish species occupy this reach, creating significant issues for the future value of this habitat for recovery of the species. Management actions to provide protected habitats where nonnative fish are not present will be important to address this issue.

One stocking site (La Paz County Park Lagoon) is within the boundaries of designated critical habitat for the razorback. This reach of critical habitat was determined to be important for delisting of the species, which equates to recovery (Maddux et al. 1993). The Parker Strip portion of the designated reach was considered particularly important at the time of designation due to the presence both wild-born and hatchery raised juvenile razorback suckers in the CRIT irrigation canals between 1974 and 1993 (Marsh and Minckley 1989, Maddux et al. 1993). Stockings of small razorbacks into the Parker Strip in 1986 were a likely source for the hatchery-raised juveniles found during that period (Schooley and Marsh 2007).

## **B. Factors affecting species environment and critical habitat within the action area**

The status of the razorback sucker in the action area is the result of changes to the natural hydrograph through construction and operation of large dams (Hoover, Davis, and Parker dams), water diversions from Headgate Rock, Palo Verde, and Imperial dams, channelization and bank stabilization actions, and the introduction of nonnative invertebrates (crayfish) and fish species. The combined effects of these activities are responsible for the current status of the razorback sucker in the action area.

The LCR MSCP is a combined section 7 and section 10 that covers management of the lower Colorado River by the Bureau of Reclamation (Reclamation), and water uses by Federal and non-Federal parties. Part of the mitigation required for the covered actions involves conservation for razorback sucker, particularly stocking into the Parker Strip and areas downstream above Imperial Dam, creation of isolated backwaters, monitoring of stocked fish, and targeted research to address issues that may interfere with successful establishment of razorback sucker populations. These mitigation and conservation actions do not alter the physical conditions in the river that result from water management, nor do they address nonnative species effects except that the isolated backwaters will be managed to keep nonnative fish out.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the razorback sucker the Recovery Goals (USFWS 2002). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on razorback sucker

No effects to razorback sucker are identified for La Paz County Park Pond, Hidden Shores, or Yuma West Wetlands since these are closed systems that do not have connectivity to the river. These sites are not discussed further in this section.

#### *La Paz County Park Lagoon*

Razorbacks stocked into the Parker Strip are over 300 mm (LCR MSCP 2009a) and are currently stocked at River Island State Park or Buckskin Mountain Park upstream of La Paz County Park mostly in the winter and early spring but with some fall stockings. Stockings of razorback suckers into the La Paz County Park Lagoon itself may occur over the period covered by this consultation. Stocked fish move away from the stocking sites and were observed and recaptured in the La Paz County Park backwater (Schooley et al. 2008). It would not be unexpected to find razorbacks in the available backwaters. All life stages of razorbacks are known to heavily use backwaters (Bradford and Gurtin 2000, Mueller 2006, USFWS 2002e). Cover is important, particularly for young fish (Mueller 2006, Albrecht et al. 2008) and may be in the form of rock piles, vegetation, or turbidity.

Exposure of stocked channel catfish, bluegill, and/or rainbow trout to razorbacks may result in competition for space and resources with the stocked razorbacks that are in the backwater when sportfish are stocked and in other portions of the Parker Strip once the block net is removed and stocked fish can exit the backwater.

The stocked razorbacks are generally within the size range of the catchable (8-12 inches (200-300 mm)) fish stocked into the backwater. Immediate predation by the stocked fish on razorbacks is likely to be limited due to similar sizes at stocking; however, any stocked warmwater fish that survive and remain in the backwater may be able to prey on subsequently stocked razorbacks that access the backwater. Stocked channel catfish that leave the backwater once the block net is removed and that have grown to larger sizes in the river may have exposure to recently stocked razorbacks.

Razorbacks take three to four years to sexually mature, with males becoming mature as early as one year of age (Mueller 2006). Generally, razorbacks stocked at 300 mm are not mature and are unlikely to spawn during their first year at large. Females stocked at more than 300 mm and at large for more than a year may reach the size to allow spawning (over 400 mm). Spawning takes place during winter and early spring on the lower Colorado River, generally January through April. Spawning areas in rivers include gravel bars and wash fans, and in backwaters on gravel and cobble substrates. Larval razorbacks use quiet water areas as nurseries, and the La Paz County Park Lagoon is one of the few available in the reach. Larval razorback suckers are at risk of predation from nonnative fish species and if potential predators are stocked into the backwater during the spawning season, there is opportunity for predation on larval razorbacks by the stocked fish, including rainbow trout.

The effects to razorbacks from the stocking of up to 6,000 cold and/or warmwater fish per year into La Paz County Park Lagoon should also be considered in light of the type of stockings and the existence of the large nonnative fish community that already exists in the river and in the backwater. The extensive population of nonnative fish species that includes self-sustaining populations of all the species proposed to be stocked (except rainbow trout) is clearly a significant factor in the potential for successful recruitment of razorbacks in this section of the lower Colorado River. The razorback suckers stocked into the river have a high rate of mortality (Schooley et al. 2008) and have not created a self-sustaining population. However, there are records of possible recruitment in the Parker Strip as evidenced by young razorbacks found in the CRIT irrigation canal system which originates at Headgate Rock Dam at the lower end of the Parker Strip (Marsh and Minckley 1989). Spawning aggregations of razorbacks have been documented in the Parker Strip (Burke 2009).

The question then becomes an issue of augmentation of the existing nonnative fish populations through the stockings. In terms of numbers, 6,000 fish is equal to the 6,000 razorback suckers proposed for stocking in the Parker Dam to Palo Verde Dam reach under the LCR MSCP (LCR MSCP 2009b), of which only a portion are scheduled for the Parker Strip. The number of stocked fish released after the blocking net is removed is likely to be very low, and compared to the numbers of their conspecifics resident in the river is unlikely to have any meaningful effect on those local populations.

However, while the stocked fish are in the backwater, they do augment the backwater population of potential predators. All the species proposed for stocking are capable of piscivory, particularly on larval or post-larval razorbacks that may be in the backwater. Stockings outside of the razorback spawning period (winter to early spring) are of less concern since small razorbacks would be less available. The proposed action calls for one of the two stockings to be in February, which is during the razorback sucker spawning period.

The stocking of nonnative fish into the backwater affects the primary constituent element for biological environment. The presence of robust populations of nonnative fish in this critical habitat reach was acknowledged in the designation (Maddux et al. 1993). The additive effect of the stockings does not substantially change the biological environment that existed at the time of the designation or is currently present, and has no effect to the recovery value of the critical habitat.

*Lower Gila River sites*

Three stocking sites are present in this complex; Wellton Golf Course Pond, Fortuna Pond, and Redondo Lake. Wellton Golf Course Pond and Redondo Lake are closed systems with no connection to the lower Gila River and fish stocked there cannot leave the stocking site. Fortuna Pond has a limited amount of connectivity to the lower Gila River and fish may move from the Pond to the river and access the mainstem Colorado River. The confluence of the Gila and Colorado is located below Laguna Dam. There are no recent records for razorback sucker in the Colorado River below Imperial Dam (Imperial Dam is upstream of Laguna Dam). Razorback suckers are stocked into the closed Imperial Ponds upstream of Imperial Dam, and into the mainstem Colorado River in the Parker Strip (described in the section on La Paz County Park). It is highly unlikely that any razorback sucker stocked into the Colorado River would access the river below Laguna Dam and encounter either a stocked fish or its progeny derived from Fortuna Pond. With the exception of rainbow trout, all species being stocked into Fortuna Pond maintain robust, self-sustaining populations in the Colorado River below Imperial Dam and the additive effect of any fish from Fortuna Pond to the extant populations of nonnative fish is insignificant.

**CUMULATIVE EFFECTS**

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The land area surrounding seven stocking sites on the lower Colorado-lower Gila rivers action area is a mix of private, state, Bureau of Land Management, Fish and Wildlife Service, Bureau of Reclamation, and Tribal lands. The sites themselves are on private lands (two), state land (two), or recreational-purposes-leased Federal lands (three). Ongoing land uses around the non-Federal properties are not expected to change during the 10-year period covered by the proposed action, with agricultural uses, urban/suburban development, and recreational uses continuing. Water management of the lower Colorado River is under Federal control, and is covered by the LCR MSCP. Fisheries on the lower Colorado River are managed by either Arizona Game and Fish Department or California Department of Fish and Game.

Live bait fish species are legal for use in all sites, with some species available from dealers and others required to be collected on site. Waterdogs are allowed, as is use of crayfish; however, live crayfish may only be used or transported on the Colorado River in a limited area along the river. The area-wide analysis looks at the effects of illegal or inadvertent transport of unwanted aquatic organisms on the larger scale.

*Verde River***Description of the action area**

The action area is the mainstem Verde River from its headwaters at Sullivan Lake to Horseshoe

Dam.

#### **A. Status of the species and critical habitat within the action area**

Historically, razorback suckers were found in the Verde River (Minckley 1973) and were stocked into the Upper Verde River 33 times between 1985 and 1993 (Hendrickson 1993, Creef and Clarkson 1993, Hyatt 2004). Recaptures of stocked razorback suckers in the Upper Verde were mostly soon after stocking, although some fish recaptured in lower Granite Creek and Stillman Lake in 1990 may have been at large one to four years after they were stocked (Hendrickson 1993). As part of the Stillman Lake native fish restoration effort, razorback suckers will be reintroduced into the lake once nonnative fish have been removed (USFWS 2009). It is expected that razorback suckers will move out of the lake during high flows and establish in the Upper Verde River.

Razorback suckers were stocked into the mainstem Verde River, Oak Creek, Wet Beaver Creek, and West Clear Creek several times from 1981 to 1988 (Hendrickson 1993). Stockings into the Upper Verde River were also occurring during this time, and stocking of fish over 300mm continued in 1991-1993 (Hyatt 2004), but none were stocked in the Middle Verde after 1988. One adult razorback sucker was captured between Tapco and Peck's Lake in 1997 (Kubacki 1998). The stocking site for this fish is unknown. Surveys from Tuzigoot to Beasley Flat in June 2003 (Clark 2003), July 2006 (Chmiel 2006a) did not locate any razorback suckers. The paucity of survey data from the Middle Verde River reach makes a determination of the presence or absence of razorback suckers in the reach difficult. As with the Upper Verde River, the razorback may not be currently present in this reach. However, if razorback suckers are repatriated to Stillman Lake as planned during the period covered by this consultation, there is a potential for individuals or their progeny to move downstream into the reach.

Beginning in 1993, larger razorback suckers were stocked outside of the Middle Verde River in the Lower Verde River reach below West Clear Creek between Beasley Flats and Childs (summarized in Hyatt 2004, Gill 2007). Razorback suckers are currently found downstream in the Lower Verde River near the stocking sites at Childs and Beasley Flats and in Horseshoe Reservoir. Successful establishment of an adult population in this reach is difficult to assess, as the numbers of fish recaptured over time has not maintained the numbers seen in the late-1990s. The presence of seven ripe adult males in Horseshoe Lake in 2005 (Robinson 2007) that had persisted in the wild from three to eight years was a promising sign.

Razorback suckers are also stocked into Fossil Creek, a tributary of the Verde River upstream of the East Verde River. The most recent stocking was in December 2009 (Robinson 2010).

Critical habitat for the razorback sucker on the Verde River was designated in 1995 and extends from the western boundary of the Prescott National Forest west of Perkinsville to Horseshoe Dam. The Verde River critical habitat unit was described in the biological support document for the designation as contributing to delisting of the species, therefore important for recovery (Maddux et al. 1993). The Upper Verde reach was described as being altered by livestock grazing, mining, and recreational use, with a diverse native fish community present. At the time of the designation, the Upper Verde River maintained populations of six native species and

nonnatives were not dominant in the system.

At the time of designation, the Verde River supported several constituent elements of critical habitat as described below:

**Water:** The Upper Verde River base flow is supported by springs near the confluence with Granite Creek. Higher flows are created through runoff from the Big Chino sub-watershed, Granite Creek, and Sycamore Creek. The Little Chino sub-basin may have been a more significant contributor to flows in the past (Wirt and Hjalmarson 2000); although that contribution may have been more contributing to baseflows via the spring system. At the time of designation, the Upper Verde River had sufficient flows and hydrological regimes to support native fish populations. Flows in the Middle Verde reach were more affected by diversions, particularly during the summer, which could nearly dewater portions of the river (Kubicki 1998). Inflows from perennial tributaries provide some relief, but also are subject to diversions. There is sufficient flow through the reach to support fish populations. The Lower Verde reach also had some inputs from tributaries, and there were no diversions in that portion of the river; however, Horseshoe Dam created Horseshoe Lake at the terminus of the critical habitat reach.

**Physical habitat:** The Verde River contained a wide variety of habitats suitable for razorback sucker. While backwaters were generally lacking, the clean substrates and pools provided opportunities for spawning and nursery habitats, although conditions downstream in the middle and lower reaches may have been more favorable for nursery habitats in backwaters and sloughs.

**Biological environment:** At the time of designation, nonnative fish species were present in the Upper Verde River but they did not dominate the aquatic fauna and native fish species were maintaining populations. In the 13 years since, populations of the other native species appear to have declined (Rinne 2001, Rinne et al. 2005, Rinne et al. 1998) as numbers of nonnatives, particularly smallmouth bass and flathead catfish, have increased. Smallmouth bass have been in the system since at least 1984 and flathead catfish since 1989. Both the Middle and Lower reaches supported robust nonnative fish populations, with Sonora and desert sucker, roundtail chub, and longfin dace also present. These native species are still present; however, the lack of consistent surveys in the reach is unable to document any population trends for either native or nonnative species.

Additional selection criteria besides the primary constituent elements were developed to assist in selecting critical habitat areas for the razorback sucker:

**Presence of spawning population:** There was no spawning population in the Verde River at the time of designation. The Verde River may have supported a spawning population of razorback suckers later than did the Gila or Salt Rivers, as the last razorback sucker from the Verde River was documented in 1954, several years after the species was gone from the other central Arizona rivers.

**Nursery habitat:** Nursery habitat is available in all reaches of the Verde River.

**Historical or present distribution:** The reintroduction of razorback sucker into the Verde River

began in the 1980s, and the river was considered occupied at the time of designation of critical habitat.

**Maintenance of rangewide distribution:** The last of the central Arizona rivers to support razorback suckers, the Verde River shares some physical characteristics with the Gila River in terms of elevational changes and the mixture of canyon and open alluvial floodplain areas. The Gila River is also free-flowing in that critical habitat reach. The significant difference is that the Gila River supported a large and dominant nonnative fish community at the time of designation, unlike the Upper Verde River.

**Special management:** The potential for groundwater development in the Upper Verde River watershed was identified as an issue of concern to maintaining suitable flows in the river to support the water and physical habitat primary constituent elements. Maintenance of a natural flow regime that would encourage native fish and discourage nonnative fish was also identified as an important management need.

## **B. Factors affecting the species' environment and critical habitat within the action area**

Razorback sucker and its designated critical habitat in the action area are affected by groundwater pumping from the aquifer that supports the headwater springs, reduction in flows from Granite Creek due to the presence of the three reservoirs that store water (Goldwater, Watson, and Willow Creek), extensive diversions through the Middle Verde River reach, watershed conditions that influence runoff patterns after storm events, and the presence of nonnative fish species. Most of the nonnative fish species currently found in the Verde River were legally or illegally introduced elsewhere in the state and either by hydrological connectivity, deliberate, illegal movement, or inadvertent transport, were moved to the Verde and became established. Efforts to control and manage groundwater use in the basin are ongoing, as are land management activities to enhance watershed conditions. Conservation actions by AGFD and The Nature Conservancy that purchased private lands in the upper portion of the critical habitat reach allows for enhanced management of the riparian areas that are part of the 100-year floodplain of the critical habitat and reduces the risk of introduction of nonnative aquatic species at those sites. The Gila River Basin Native Fishes Conservation Program is involved with planning for a fish barrier in the reach that would allow the eventual renovation of the reach to remove nonnative species. Nonnative removal efforts at Stillman Lake in 2009 are an example of the types of future conservation actions envisioned. In addition, the Salt River Project Verde River Habitat Conservation Program includes some conservation measures for razorback sucker.

We believe the current status of the razorback sucker in the action area is the result of past land management actions that affected the watershed and the introduction of nonnative aquatic species.

## **EFFECTS OF THE ACTION**

Potential impacts to razorback suckers in the Verde River would result from transportation of largemouth bass, black crappie, bluegills, and rainbow trout or the progeny of the warmwater

species downstream to occupied habitat through Granite Creek, movement of stocked rainbow trout from the East Verde River, Oak Creek, West Clear Creek, and Wet Beaver Creek into the mainstem Verde River, and stocking rainbow trout into the mainstem Middle Verde River. The response would be potential predation by the stocked fish or their progeny on the razorback sucker (particularly on larval and juvenile individuals) or potential competition for food or space where habitats overlap. Largemouth bass are of particular concern due to their high level of predation risk to small native fish. Black crappie over 100 millimeters switch from being planktivores to focusing on threadfin shad (Minckley 1973), and thus pose a predation risk to larval razorback suckers. Bluegills are not particularly predaceous, but do consume fish larvae or small fishes on occasion (Minckley 1973). Stocked rainbow trout are documented feeding on larval razorback suckers (Muller 1993). Largemouth bass were documented eating desert and Sonora suckers (Bonar et al. 2004) in the Verde River. There is a considerable overlap in preferred habitats between these species, with pools being preferred over runs and riffles (Bonar et al. 2004).

#### Granite Creek sites

Although the action area includes the upper Verde River reach that could be affected by sportfish escaping from the three Granite Creek stocking sites (Goldwater Lake, Watson Lake, and Willow Creek Reservoir), razorback suckers are not currently present in this reach. Conservation stockings are likely to be made over the 10-year period covered by this consultation; however, effects of the proposed action on future actions are not under consideration in this BCO and will be considered at the time of any future razorback sucker stocking effort. However, we believe that the effects of the proposed stocking action on the nonnative fish community of the upper Verde River are very limited, and, are unlikely to have any significant effect on the success of any razorback sucker reintroduction effort (please see additional discussion in the analysis for spikedace). Conservation actions undertaken by the Gila River Basin Native Fishes Conservation Program in the upper Verde River would provide for reductions in the nonnative fish community that would benefit the razorback sucker.

#### Middle and Lower Verde sites

Potential impacts to the razorback sucker in the Middle Verde River result from the stocking of rainbow trout into the mainstem Verde River, Oak Creek, Wet Beaver Creek, West Clear Creek and the East Verde River. Effects from stockings in tributaries would occur if the stocked fish moved down into the mainstem or if razorback suckers moved into the stocking reaches of Oak Creek, Wet Beaver Creek, West Clear Creek or the East Fork Verde River, particularly during the spawning period for razorback suckers (April [Robinson 2007]). If razorback suckers in Fossil Creek begin to reproduce, larval or young of the year fish may be moved out of the creek by natural flows and may also interact with rainbow trout.

A total of 134,000 catchable sized rainbow trout are proposed for stocking in the mainstem from November to March and in the tributaries from March to May and October to November or April though August for the East Verde. All fisheries are intended for high intensity use with repeated stockings during the period to maintain sufficient fish for anglers. Kubacki (1998) estimated a return to the creel of stocked trout of 50% in 1997 and 61% in 1998. He also notes that the 78%



return from 1996 was done under a different census and should not be compared with the later results. Later creel results from 2000 indicated a return of 40%.

Rainbow trout are stocked during the probable spawning period for razorback suckers in the Verde River. Robinson (2007) caught seven tuberculate, ripe males in one gill net set in Horseshoe Reservoir in April 2005 where the water had a surface temperature of 19°C. The cluster of males is indicative of staging behavior during the spawning period. No ripe females have been found. No surveys for larval razorback suckers has been initiated, so it is unknown if there is any spawning occurring. Rainbow trout are stocked into the mainstem from November through March and into the tributaries between March and May. Persistence until May in the river is documented and temperatures in the area currently known to be occupied by razorback suckers (Beasley Flat to Horseshoe Reservoir remain suitable for rainbow trout until at least April (Robinson 2007). Rainbow trout in the Verde River prefer pools and runs, with razorback suckers preferring pools. Larval and young of the year razorback suckers use quiet waters, either in pools, backwaters, or shallow side channels with vegetative or rock cover for nursery habitat.

Studies in the mid-1990s indicated that stocked trout in the Middle Verde River did not move upstream (Kubacki 1998); however, there is limited information on the downstream movement of rainbow trout post-stocking into the mainstem and tributaries. Survey information on the Middle Verde River is limited; Kubacki (1998) found rainbow trout at the stocking sites, with two caught as late as May. Bonar et al. (2004) did find rainbow trout in this reach but it is not clear if captures were made in both spring (March-May) and winter (October-November). He did observe rainbow trout in the Verde River in August (four months after final stockings were done in April), but none were captured in June-September. His survey sites were on the mainstem near Wet Beaver Creek and West Clear Creek and states that rainbow trout were found near the stocking sites. (Clark 2003) surveyed between Tuzigoot Bridge and Beasley Flats in June, 2003, and did not detect any rainbow trout. Chmiel (2006b) repeated that survey in July, 2006, and did not find any rainbow trout. Water temperatures in the Middle Verde River can exceed 25°C during the summer months, reducing the opportunity for rainbow trout to persist through the summer. Wild trout (both rainbow and brown) do persist in upper Oak Creek, but the lower reaches of the three stocked tributaries also have high summer temperatures that reduce the opportunity for over-summer persistence.

The seasonal distribution of rainbow trout below West Clear Creek to Horseshoe Reservoir is unclear; however, they would only be present during the stocking season and into late spring and would not be a reproducing population. Bonar et al. (2004) had a survey site at West Clear Creek and the Verde River, and likely that is the source of the rainbow trout they captured in their Reach III. The series of surveys in the Childs to Sheep Bridge and in Horseshoe Reservoir have not documented rainbow trout in that area, even with some surveys done at the times of the year that rainbow trout could be expected to be in the system.

Stocked razorback suckers are too large to be subject to predation by rainbow trout, however, there may be some co-use of pools and both use invertebrate populations as food. The number of stocked rainbow trout that may access occupied razorback sucker habitats is likely low due to angler catch, natural mortality, and the distances involved. Although razorback sucker populations are not known to be reproducing at this time, rainbow trout are documented to prey

on razorback sucker larvae in the wild (Mueller 1993) and in a laboratory setting (Carpenter and Mueller 2008). While rainbow trout are not considered particularly piscivorous, they do prey on small fish (Bonar et al. 2004, Propst et al. 1998) and once stocked, can apparently turn to feeding on natural food quickly (Propst et al. 1998). Bonar et al. (2004) also noted that stocked rainbow trout were primarily feeding on insects.

Potential impacts to designated critical habitat in the Middle and Lower Verde River are related to the continuation of stocking of an additional nonnative predatory fish into the system. Rainbow trout are less of a potential predator than the existing warmwater fish community, they are only seasonally present in a portion of the unit, and they are not stocked directly into the occupied portion of the critical habitat unit; however, they may have an impact to food resources while they are present during and shortly after the stocking period. Also, they temporarily reduce the suitability of available pool habitat and its forage base needed by razorback suckers since rainbow trout are stocked in blocks of large numbers in the stocking sites and until the populations are reduced by natural mortality or anglers, razorback suckers could be displaced. This effect is temporary until the remaining rainbow trout all die due to high temperature. Stocking of rainbow trout was occurring at the time critical habitat was designated, and implementation of the proposed action maintains the status quo of nonnative predators in the critical habitat unit. Non-stocked species, such as smallmouth bass, have expanded into the critical habitat unit and reduced recovery value of the unit due to increased predation potential. Continuing the stocking of rainbow trout allows for the temporal effect of rainbow trout presence to be felt; however, that effect is not significant to the recovery value of this critical habitat unit.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The remainder of the Verde River in the action area is a mix of private lands in the Verde Valley (Clarkdale through Camp Verde) and lands contained in the Coconino, Prescott, and Tonto National Forests. Land management on the national forest is subject to section 7 consultation.

Groundwater pumping and existing water diversions will continue to be factors affecting flows in the Verde River.

The use of live baitfish is prohibited at waters in Yavapai County, including the Granite Creek stocking sites, so there is little impetus for anglers to introduce these species to the upper Verde River to create sources for use in the Granite Creek stocking sites. Waterdogs are legal; however, waterdogs are not used as bait for the fish species stocked under the proposed action. Of the nonnative species that maintain populations in the upper Verde River, only red shiner (a species used for bait in other portions of the state) were stocked into one of the reservoirs (Watson); fathead minnow, and green sunfish are other bait species that were likely illegally introduced to the upper Verde River in the past and now maintain populations in the river. Some of the records for largemouth bass, particularly those at Stillman Lake, may also be the result of

illegal stockings.

While certain live baitfish species are legal for use in portions of the Middle and Lower Verde River, none are generally used for fishing for stocked rainbow trout.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide analysis discusses this effect in more detail.

Disease and parasites are additional threats to razorback sucker populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Asian tapeworm is generally not an issue for suckers (Knapp and Mueller 2004); however Bean (2008) did document the parasite in the blue sucker (*Cycleptus elongatus*) in the Rio Grande in Texas. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect razorback sucker. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

#### CONCLUSION

After reviewing the current status of razorback sucker and its critical habitat on the lower Colorado River and Verde River, the environmental baseline for the action area, the effects of the proposed sportfish stocking and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the razorback sucker, and is not likely to destroy or adversely modify designated critical habitat.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

We present this conclusion on razorback sucker for the following reasons:

- Stocking into the La Paz County Park Lagoon provides limited opportunity for adverse effects to razorback sucker through competition for food and space with stocked fish and predation on larval razorback suckers by stocked fish. The length of exposure is low; the number of razorback suckers potentially exposed to the stocked fish is low; and the amount of competition is low. The overall significance to the razorback sucker in the Parker Strip area of the Colorado River is low. No effects to razorback suckers are anticipated from stockings at Hidden Shores, La Paz County Park Pond, or Yuma West Wetlands since these sites are not connected to the river and fish stocked there will not reach the river.
- It is highly unlikely that any razorback sucker stocked into the Colorado River would access the river at the confluence of the Gila River and encounter either a stocked fish or its progeny derived from Fortuna Pond. With the exception of rainbow trout, all species being stocked into Fortuna Pond maintain robust, self-sustaining populations in the Colorado River below Laguna Dam and the additive effect of any fish from Fortuna Pond to the extant populations of nonnative fish is insignificant. No effects to razorback sucker are anticipated from stockings at Redondo Lake and Wellton Golf Course pond since these sites are not connected to the Gila River.
- For the Middle and Lower Verde River, based on current knowledge of the location of stocked razorback suckers versus the stocking locations, there is a limited opportunity for overlap between razorback suckers and rainbow trout to allow for competition for food and space or potential predation by rainbow trout on larval razorback suckers.
- The proposed actions do not increase the current status of nonnative fish populations in either the Parker-Imperial or Verde River critical habitat reaches. The small numbers of stocked fish likely to remain in the Parker-Imperial reach after the barrier net is removed is inconsequential to the existing populations of these species in the river. The small numbers of stocked sportfish that may access the Upper Verde River reach is not likely to lead to the establishment of these species in the area, and the effect of the small numbers of individuals likely to move into the area from the Granite Creek stocking sites does not alter the existing predator and competitor community currently present. The stocking of rainbow trout into the Middle and Lower Verde River has a temporary effect of increasing the biomass in the reach, and introducing a “new” species to the reach. However, because this species is only temporarily present, has a limited effect on the physical habitat and biological environment, and is not expected to establish in the stocking reaches, the effects are minor. In no case does the effect of sportfish stocking reduce the value for conservation for the razorback sucker of any affected critical habitat reach.

- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Lower Colorado River and lower Gila River: Razorback sucker into the lower Colorado River and lower Gila River are unlikely to be exposed to stocked fish or their progeny from all sites except La Paz County Park Lagoon. Thus, the first condition is not met.
- La Paz County Park Lagoon: The Lagoon is one of only a few backwaters in this reach of the Colorado River, and it is likely that stocked razorback sucker will be using the Lagoon during the year. The first condition is met. Stocked razorback sucker and the stocked sportfish are of similar size, and predation is not likely to occur on razorback sucker. Further, the stocked sportfish will only be in the Lagoon for a limited time, and the opportunity for competition for food and space will be limited and unlikely to rise to

the level that take would occur. Stocked razorback sucker that achieve maturity in the Parker Strip reach of the lower Colorado River do spawn in the mainstem, so there is an opportunity for larval razorback suckers to be present in the Lagoon at the time of the stocking actions. However, we are not reasonably certain that take from predation would occur because (a) the stocked fish are from hatcheries and are not used to foraging for themselves; (b) the stocked fish will be quickly caught out during the fishing derby/kids fishing opportunity and will have limited time to adapt to foraging for food; (c) the number of razorback sucker larvae likely to be in the backwater during the time the stocked fish are present is likely to be low; and (d) the extant population of wild nonnative fish already in the backwater are more effective predators on larval razorback suckers and, based on past experience, are likely to eliminate any larvae present. Thus, the second condition is not met.

- Middle and Lower Verde River: Rainbow trout are not stocked into the area currently known to be occupied by stocked razorback suckers and the number of individual stocked rainbow trout that could reach razorback habitats is likely to be very low. Similarly, although stocking actions would occur during the period when razorback sucker are spawning, we cannot be reasonably certain that a stocked rainbow trout would be in the area where larval razorback suckers were present in order for predation to occur. We are not reasonably certain that razorback sucker would be exposed to stocked rainbow trout, thus the first condition is not met.

### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for razorback sucker contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery

actions for razorback sucker under the auspices of the Program provides conservation benefits to razorback sucker that may not be otherwise realized.

2. We recommend that AGFD participate in protection of the upper Verde River through barrier construction, with emphasis on developing an ecologically sound basis for barrier placement with an emphasis on the management of listed and other native species.
3. We recommend that AGFD participate in development of suitable renovation efforts in the upper Verde River.
4. As recognized in the BA, conservation and enhancement of the upper Verde River's native aquatic community is critically important to the future persistence and existence of native fish species. Development of a native fisheries management plan for the Upper Verde River Wildlife Area would enhance protection in this area.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### **Sonoran tiger salamander (*Ambystoma mavortium stebbinsi*)**

#### **DESCRIPTION OF THE PROPOSED ACTION**

The Sonoran tiger salamander (salamander) may be affected by the stocking of rainbow trout, bluegill, redear sunfish, and channel catfish into Parker Canyon Lake. Rainbow trout would be stocked annually multiple times between October and April. Two of the three warmwater species are new species proposed for stocking (bluegill and redear sunfish) that would only be stocked if the fishery for that species required augmentation or after a catastrophic event.

#### Conservation measures included in the proposed action

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent

inadvertent transport of such nonnative species.

AGFD shall work with Federal, state, and private partners to identify and implement projects that reduce the risk of hybridization between Sonoran tiger salamanders and nonnative salamanders. This measure will be completed by year 10.

## STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

### *Listing*

The Sonoran tiger salamander was listed as an endangered species in 1997 (62 FR 665) (USFWS 1997a) as the Sonora tiger salamander. The listing covered the entire historical range in the United States and Mexico. Critical habitat was not designated for the salamander. The Sonora Tiger Salamander Recovery Plan was finalized in 2002 (USFWS 2002f). Common and scientific names used herein follow Crother (2008).

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the salamander. This information was taken from the recovery plan (USFWS 2002f) and the 5-year review (USFWS 2007a). Information in these documents is incorporated by reference.

### *Life history*

The Sonoran tiger salamander is a large salamander with a dark venter and light-colored blotches, bars, or reticulation on a dark background. Snout-vent lengths of metamorphosed individuals vary from approximately 2.6-4.9 inches (Jones et al. 1988, Lowe 1954).

Larval salamanders are aquatic with plume-like gills and well-developed tail fins (Behler and King 1980). Larvae hatched in the spring are large enough to metamorphose into terrestrial salamanders from late July to early September, but only an estimated 17 to 40 percent metamorphose annually. Remaining larvae mature into branchiates (aquatic and larval-like, but sexually mature salamanders that remain in the breeding pond) or over-winter as larvae (Collins and Jones 1987, Collins et al. 1988, Jones et al. 1988).

### *Habitat use*

Historically, the Sonoran tiger salamander probably inhabited springs, ciénegas, and possibly backwater pools of the Santa Cruz River and streams in the San Rafael Valley where permanent or nearly permanent water allowed survival of mature branchiates. The grassland community of the San Rafael Valley and adjacent montane slopes, where all extant populations of Sonoran tiger salamander occur, may represent relictual grassland and a refugium for grassland species. Tiger salamanders in this area might have become isolated and, over time, genetically distinct from ancestral *A. m. mavortium* and *A. m. nebulosum* (Jones et al. 1995, Storfer et al. 2004).



Although most records for Sonoran tiger salamanders occur at stock tanks where breeding occurs, terrestrial metamorphs potentially may wander considerable distances from these aquatic habitats, and are occasionally encountered in upland habitats. A Sonoran tiger salamander was captured in a pit fall trap at Oak Spring in Copper Canyon, Huachuca Mountains, by Arizona Game and Fish Department personnel. The nearest known breeding site is approximately 0.6 mile to the south, suggesting the salamander may have moved at least that far. Capture in a pit fall trap also confirms that the individual was surface active. In other subspecies of *Ambystoma mavortium* and the closely related *A. tigrinum*, metamorphs may disperse hundreds of meters from the breeding pond, or may remain nearby (Petranka 1998, Gehlbach et al. 1969). Of hundreds of marked *Ambystoma m. nebulosum* in northern Arizona, two were found to move from 0.9-1.2 miles to new ponds (J. Collins, pers. comm. 1998). On Fort Huachuca, Sheridan Stone (pers. comm. 1998) reported finding terrestrial tiger salamanders (probably *A. m. mavortium*) 1.9-2.5 miles from the nearest known breeding pond. Referring to conservation of the California tiger salamander, *A. californiense*, Petranka (1998) finds that based on studies of movements of other *Ambystoma* species, conservation of a 650-1,650 foot radius of natural vegetation around a breeding pond would protect the habitat of most of the adult terrestrial population. Adults of *A. mavortium* subspecies typically live in or about mammal burrows (Petranka 1998), although metamorphs may construct their own burrows, as well (Gruberg and Stirling 1972, Semlitsch 1983). Some species of salamanders exhibit seasonal migrations of up to several miles each way from breeding sites to upland habitats (Stebbins and Cohen 1995). If such migrations occur in the Sonoran tiger salamander, we have no information about migration corridors or non-breeding habitat. Because of the arid nature of the environments in the region where the subspecies occurs, if salamanders move very far from breeding ponds, they likely do so during more mesic times of year, such as during the monsoon season.

The Sonoran tiger salamander apparently has opportunistically taken advantage of available stock tank habitats as natural habitats disappeared (Hendrickson and Minckley 1984) or were invaded by nonnative predators with which the salamander cannot coexist (USFWS 2002f).

#### Current distribution

All sites where Sonoran tiger salamanders have been found are located in Arizona in the Santa Cruz and San Pedro river drainages, including sites in the San Rafael Valley and adjacent portions of the Patagonia and Huachuca mountains in Santa Cruz and Cochise counties. All confirmed historical and extant aquatic populations are found in cattle tanks or impounded cienegas within 19 miles of Lochiel, Arizona. Salamanders collected from a cienega at Rancho Los Fresnos in the San Rafael Valley, Sonora, may be *A. m. stebbinsi* (Varela-Romero et al. 1992). However, surveys during 2006-2008 failed to locate additional salamanders and most waters on the ranch are now occupied by nonnative bullfrogs, crayfish, green sunfish, and/or black bullhead (trip reports, USFWS files).

The Sonoran tiger salamander is known from 71 aquatic localities, although not all are currently occupied (USFWS 2002f and files, Abbate 1998, Collins and Jones 1987, Collins 1996). During intensive surveys in 1997, from one to 150 Sonoran tiger salamanders were found at 25 stock tanks (Abbate 1998). Populations and habitats are dynamic, thus the number and location of extant aquatic populations change over time, as exhibited by the differences between survey

results in 1985 and 1993-1996 (Collins and Jones 1987; Collins 1996; James Collins, pers. comm. 1996). In 1999, the lab of Dr. James Collins, Arizona State University, found Sonoran tiger salamanders at 17 localities (Collins 1999). During surveys by the Arizona Game and Fish Department from 2001-2006, Sonoran tiger salamanders were found at 37 of 139 stock tanks, which were sampled from 1-7 times each. At 23 of 29 tanks where salamanders were found, and which were sampled more than once, salamanders were not found on at least one visit. The 5-year review acknowledges that there is no current information that clearly defines the abundance or population trends for this species (USFWS 2007a) but does state that the current survey data are consistent with population levels discussed in the recovery plan (USFWS 2002f).

### Threats

Primary threats to the salamander include predation by nonnative fish and bullfrogs, diseases, catastrophic floods and drought, illegal collecting, introduction of other subspecies of salamanders that could genetically swamp *A. m. stebbinsi* populations, and stochastic extirpations or extinction characteristic of small populations. Predation by catfish, bass, mosquito fish, and sunfish can eliminate stock tank populations of Sonoran tiger salamander (Collins et al. 1988, Jonathan Snyder, Arizona State University, pers. comm. 1996). The salamanders can apparently coexist with bullfrogs, but bullfrogs prey on salamanders (J. Snyder, pers. comm. 1996) and perhaps if they are present in sufficient densities could reduce or eliminate salamander populations. Tadpoles of wood frogs (*Lithobates sylvatica*), are known to feed on spotted salamander (*Ambystoma maculatum*) eggs (Petranka et al. 1998), but under experimental conditions bullfrog tadpoles did not feed on viable salamander eggs or hatchlings (Collins 1996, J. Collins, pers. comm. 1996).

Recent genetic analysis confirmed that barred salamanders (*A. m. mavortium*) or hybrids between barred salamanders and Sonoran tiger salamanders are present at seven stock tanks along Highway 83 and near Parker Canyon Lake in the San Rafael Valley (Ziemba et al. 1998, Storfer et al. 2004). A salamander population in Garden Canyon, Fort Huachuca, near the crest of the Huachuca Mountains, also contains hybrids. Barred tiger salamanders are likely present due to their illegal use as fish bait in and around Parker Canyon Lake, although there is no way of knowing when those animals were introduced. Continuing introgression by nonnative salamander genes into the Sonoran tiger salamander may eventually eliminate the species as a distinct evolutionary unit.

Tiger salamander populations in the western United States and Canada, including populations of the Sonoran tiger salamander, exhibit frequent epizootics (Collins et al. 1988, Collins et al. 2001). Sonoran tiger salamander populations experience frequent disease-related die-offs (approximately eight percent of populations are affected each year) in which almost all salamanders and larvae in the pond die (Collins et al. 1988). *Ambystoma tigrinum* virus (ATV) is the pathogen believed to be primarily responsible for these die-offs (Jancovich et al. 1997). These, and possibly other iridoviruses, are also apparently the proximate cause of die-offs observed in other *Ambystoma* salamander populations in the United States and Canada (Collins et al. 2000, Docherty et al. 2003, Brunner et al. 2004, Schock et al. 2008). ATV might be spread by bullfrogs, birds, cattle, or other animals that move among tanks (Jancovich et al. 1997); however, the viral life cycle appears to be restricted to tiger salamanders - no other syntopic

hosts have been identified (Jancovich et al. 2001). In the laboratory, Sonoran tiger salamanders exhibited lower survival and growth rates when exposed to the disease as compared to *Ambystoma mavortium nebulosum* from the White Mountains of Arizona (Collins et al. 2003). Animals that survive ATV exposure may harbor transmissible infection for more than six months. Dispersing metamorphosed salamanders have been found carrying ATV, and when they return to a pond to breed, may reinfect the aquatic population (Collins et al. 2003). The disease could be spread by researchers or anglers if equipment such as waders, nets, or fishing tackle used at a salamander tank are not allowed to dry or are not disinfected before use at another tank. ATV is an emerging pathogen (Storfer 2003), and genetic analysis suggests a single introduction and recent spread over a large geographic area from Arizona to Saskatchewan (Jancovich et al. 2005). ATV may have switched from sport fishes to salamanders or was introduced with water dogs (*A. m. mavortium*) imported for use as fish bait in Arizona and elsewhere (Jancovich et al. 2005). ATV has been identified in waterdogs obtained from a Phoenix bait shop (Collins et al. 2003, Picco and Collins 2008). Continuing illegal use of nonnative tiger salamanders at Parker Canyon Lake remains a primary threat for both introgression and disease transmission.

Sonoran tiger salamanders also contract chytridiomycosis, a fungal disease associated with global declines of frogs and toads (Davidson et al. 2003, Speare and Berger 2000, Longcore et al. 1999, Berger et al. 1998). However, compared to anurans, infected salamanders exhibit only minimal symptoms (Davidson et al. 2000). In the laboratory, infected Sonoran tiger salamanders did not die from the disease and were capable of ridding themselves or much reducing chytrid infections by frequent sloughing of the skin (Davidson et al. 2003). The effect of the disease on salamander populations needs further study.

Some die-offs were thought to occur as a result of low pH (M. Pruss, AGFD, pers. comm.). A copper smelter at Cananea, Sonora, less than 25 miles south of the border, may have released sulfur plumes resulting in acid precipitation (Platz 1993, Blanchard and Stromberg 1987), but currently there is no evidence to connect salamander die-offs with the copper smelter, and the smelter has not operated since 1999.

With the exception of Bog Hole in the San Rafael Valley, a site on Fort Huachuca, and Rancho Los Fresnos, cattle grazing occurs throughout the range of the Sonoran tiger salamander. Cattle can degrade habitat at stock tank breeding sites and overgrazing can cause loss of cover and erosion that can threaten the integrity of stock tanks used by the salamander. However, the salamander has coexisted for about 250 years with grazing and because of its current use of livestock tanks for breeding, is now dependent upon maintenance of cattle waters by ranchers (USFWS 2002f).

For further information on the ecology, taxonomy, range, and threats to this subspecies, refer to USFWS (2002f), Collins (1981, 1996), Collins and Jones (1987), Collins et al. (1988), Collins et al. (2003), Crother (2008), Gehlbach (1967), Jancovich et al. (1997), Jancovich et al. (1998), Jancovich et al. (2005), Jones et al. (1988), Jones et al. (1995), Lowe (1954), Snyder et al. (1996,1998), Storfer (2003), and Storfer et al. (2004) and the 5-year review (USFWS 2007a).

Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the Sonoran tiger salamander recovery plan.

Conservation actions ongoing for the salamander throughout its range include surveys and monitoring of populations, improvements to stock tanks that provide habitat, and when documented, enforcement of prohibition of illegal stocking of barred tiger salamanders in the habitat of the salamander. The species is a covered species in the draft San Rafael Cattle Company Habitat Conservation Plan, which will provide conservation benefits for the species in a portion of the San Rafael Valley

#### *Previous consultations*

Section 7 consultations on Sonoran tiger salamanders include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, and wildfire/prescribed burns), and military base operations, conservation actions for the species. Biological opinions on actions potentially affecting Sonoran tiger salamanders may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

The action area is Parker Canyon Lake and the watershed surrounding the lake within a five mile radius where salamander habitat exists in tanks and other small waters. Also included are the ephemeral and perennial waters in Parker Canyon below Parker Canyon Dam to its confluence with the Santa Cruz River. There is occasional connectivity between the waters below the dam and the Santa Cruz River; however, such connections are not long-lasting and stocked sportfish from the lake that end up at the Santa Cruz River do not persist, nor can they reach salamander habitats in the San Rafael Valley. There is some potential for salamanders moving from tanks near the lake could access the area below the lake and be exposed to stocked sportfish or their progeny.

#### **A. Status of the species within the action area**

Sonoran tiger salamanders occur in and around stock tanks near Parker Canyon Lake within the upper Santa Cruz River watershed. Breeding populations of Sonoran tiger salamanders are found in stock tanks near the lake. Stock tanks within an approximately 5 mile radius of Parker Canyon Lake (n = 30) have been sampled over 200 times from 1999 – 2008, and most were

surveyed multiple times (range 1 – 22). Sonoran tiger salamanders have been documented at 18 of those sites one or more times (AGFD Sonoran tiger salamander database, T.R. Jones pers. comm.). Salamanders have never been documented at Parker Canyon Lake (HDMS). The 18 sites in the action area with documented salamanders are half of the number of sites with salamanders found across its range (37) (USFWS 2007a). As discussed under the range-wide status, nonnative tiger salamanders illegally used as bait at Parker Canyon Lake are found in tanks in the vicinity of the lake, and hybrids between these barred tiger salamanders and the Sonoran tiger salamander were found in five tanks. Hybridization and genetic swamping is a significant threat to the salamander and threatens the existence of the species, and disease transmission by introduced waterdogs is a continuing concern.

## **B. Factors affecting the species' environment within the action area**

Managed livestock grazing, road use and maintenance, and other land management actions occur within the action area on Federal and private lands. Section 7 consultations on the Coronado National Forest lands which make up the majority of the action area consider the presence of the salamander and the effects of actions on its status. Management actions to maintain or enhance stock tanks that provide salamander habitats in the action area may provide benefits to the species.

The presence of nonnative invertebrates (crayfish), amphibians (barred tiger salamanders, bullfrogs), fish (largemouth bass, green sunfish, bluegill, and mosquitofish) in the action area poses a continuing threat to the salamander through predation or competition for limited resources in the small tanks that support the species. The sources of these nonnative species include both past illegal or inadvertent transport events and past legal stockings of the species into tanks or fishing waters. Illegal use of barred tiger salamanders for bait, and, the subsequent release of live individuals into the lake or tanks in the vicinity allows for hybridization and the spread of ATV.

Drought affects the sustainability of breeding tanks which must retain water long enough to allow young salamanders to reach the size needed to metamorphose. The status of the salamander, particularly regarding the continuing threat of hybridization, is of significant concern.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

The direct effects to the salamander relate to predation by stocked sportfish if individual salamanders access Parker Canyon Lake or the area below the dam that contains perennial or

ephemeral water.

Collins et al. (1988) concluded that Sonoran tiger salamanders were invariably eliminated by predatory exotic fishes, especially centrarchids and ictalurids, and predation by fish has been identified as a primary threat to the salamanders' continued existence (USFWS 2002f). Maret et al. (2006) found that risk of local extirpation of salamander populations was increased by introduced fish, and if fish eliminated salamanders, the salamanders would not recolonize sites successfully unless fish had been eliminated. Adult metamorphosed Sonora tiger salamanders might not return to the water except to breed from January through May. At that time they are at risk of predation if they enter habitats like Parker Canyon Lake containing large predatory fishes. Any eggs or larvae produced in Parker Canyon Lake would be at similar or higher risk.

The degree to which tiger salamanders would enter permanent water containing predatory fishes is not known. Although one might expect strong selection against those individuals that exhibit such behavior, data to test that assumption are few. Experiments with spotted salamanders (*Ambystoma maculatum*), an ecologically similar salamander, indicate that breeding spotted salamanders do not avoid ponds with predatory fishes (Sexton et al. 1994), and those that failed to detect fish and bred in those ponds never produced metamorphosed young (Ireland 1989). Collins et al. (1988) provided data to suggest that Sonora tiger salamanders recolonized stock tanks that had recently supported fishes, indicating that the salamanders might not discriminate among breeding sites.

There are few data to evaluate the extent to which metamorphosed Sonoran tiger salamanders move away from breeding ponds. But, marked Sonoran tiger salamanders have been found 1.5 and 2 km from tanks where they had been found the previous spring, and others have been found 3–4 km from the nearest potential source population (Maret et al. 2006). The sites nearest to Parker Canyon Lake that have been known to support Sonoran tiger salamanders and their straight-line distances from the lake include: Hannah Tank (1.7 km), Heidi Tank (2.8 km), High Berm Tank (2.7 km), Dinner Tank (3.4 km) and Bill Woods Tank (4.2 km), all of which are presumably close enough for salamanders to disperse to Parker Canyon Lake. In the lake, largemouth bass, northern pike and channel catfish are the most likely predators. Consequently, it is possible that Sonoran tiger salamanders could enter Parker Canyon Lake, but we do not know how likely that would be. Of the species proposed for stocking, channel catfish would have the greatest potential to prey on salamanders that reached the lake.

Surveys of Parker Canyon downstream of the dam were completed in 1997 and 2004. In 1997, the fish population consisted of green sunfish, largemouth bass, and bluegill, within the 1 mile perennial section of Parker Canyon directly below the lake (D. Mitchell, AGFD, pers. comm.). A 2004 survey of the drainage below the lake to Mexico showed the fish community consisted of green sunfish, largemouth bass, mosquitofish, and longfin dace in the two perennial reaches (Stefferdud and Stefferud 2004). Catfish species have never been documented within the perennial section of Parker Canyon below the dam (Stefferdud and Stefferud 2004).

Four species of nonnative fish; largemouth bass, bluegill, green sunfish, and mosquitofish, were detected in four of 139 salamander habitats by AGFD surveys in 2001-2006 (USFWS 2007a). The presence of these species in the tanks was likely the result of illegal stocking since none

were hydrologically connected to locations where these species are known. Bluegill is a species proposed for stocking under the proposed action, largemouth bass is not. Populations of both species in Parker Canyon Lake were the result of illegal stocking.

The addition of bluegill and redear sunfish to the proposed action does not have a significant additive effect to the potential effects to Sonoran tiger salamander. Bluegill are already present in the lake, and it is unlikely that the species would be totally eliminated even if the population was depressed enough to require augmentation. Redear sunfish are unlikely to be competitors or predators on Sonoran tiger salamanders, so no additional effect accrues to their establishment in the lake.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Use of live bait fish or barred tiger salamanders (waterdogs) is prohibited at Parker Canyon Lake and collection of waterdogs is prohibited throughout the range of the salamander (AGFD 2009). Parker Canyon Lake was established as a trout fishery; however, with the exception of rainbow trout and channel catfish, all the species currently in the lake were established as a result of illegal stocking actions. These species include largemouth bass, and is one species for which waterdogs are used as bait. The proposed action does not include stocking of largemouth bass, so there is no interrelated or interdependent effects that connect the illegal use of waterdogs to the proposed action. However, illegal use of waterdogs, as described previously, is a continuing threat to the genetic integrity of the salamander and is a source of disease and this use is not expected to be eliminated over the 10-year period covered by this consultation. Fortunately, while this introgression has occurred, it has not yet contaminated a significant portion of the extant salamander populations (Storfer et al. 2004). The area-wide analysis will look at the effects of illegal or inadvertent transport of unwanted aquatic organisms on the larger scale; however, due to the significance of this activity to the salamander, we include this brief discussion of the issue here.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in the Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide

analysis discusses this effect in more detail.

## CONCLUSION

After reviewing the current status of the Sonoran tiger salamander, the environmental baseline for the action area, the effects of the proposed sportfish stocking at Parker Canyon Lake and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Sonoran tiger salamander. No critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on the Sonoran tiger salamander for the following reasons:

- Direct effects to individual salamanders from exposure to stocked fish species or their progeny is limited by inability of stocked sportfish to reach occupied salamander habitats and the low number of salamander populations within expected salamander movement distances from those sites to the lake.
- Survey information from 139 tanks through 2006 documented only four tanks containing one or more of four nonnative fish species in salamander habitats. It is unclear if illegal movement of fish species is an ongoing activity; however, the low number of compromised habitats indicates that if it occurs, the level is likely low.
- Hatchery and operational protocols reduce the risk of inadvertent introduction of unwanted aquatic species (including diseases or parasites) via stocking events. This reduces the risk for adverse effects from these organisms to occur in the salamander population but does not entirely eliminate them.
- The risk of disease transfer and hybridization through illegal use of waterdogs at Parker Canyon Lake does not affect the other portion of the occupied habitats in the San Rafael Valley and currently is of limited extent near Parker Canyon Lake (primarily in tanks along Highway 83).
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.
- Conservation measures to address the risks from introduction of nonnative tiger salamanders are included in the proposed action.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take



of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Parker Canyon Lake: Sonoran tiger salamanders would only be exposed to stocked sportfish if they dispersed to the lake. There are occupied tanks within the dispersal distance for salamanders, so adult salamanders may occasionally be present at the lake. The first condition is met. Rainbow trout are unlikely to be predators or competitors with adult salamanders. Resident populations of warmwater predatory fish, including the stocked species, are present in the lake. Stocking actions for these species may or may not occur over the 10-year period covered by this consultation. Further, it is unlikely that the resident populations of these species would be eliminated prior to an augmentation stocking, so it is difficult to determine if the proposed action would result in the take. The second condition is not met.

#### Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for Sonoran tiger salamander contingent upon CAMP funding availability as described in the Program document. The ability to implement recovery actions for Sonoran tiger salamander under the auspices of the CAMP provides conservation benefits to Sonoran tiger salamander that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### Southwestern willow flycatcher (*Empidonax traillii extimus*) and critical habitat

#### DESCRIPTION OF THE PROPOSED ACTION

Southwestern willow flycatchers (flycatcher) and their designated and proposed critical habitat may be affected by the stocking activities in the locations listed in Table 16.

Table 16: Stocking sites, survey information, and presence of designated critical habitat for southwestern willow flycatchers.

| Stocking complex/site                    | Last year detected/ most recent survey year | Critical habitat |
|------------------------------------------|---------------------------------------------|------------------|
| <i>Little Colorado River above Lyman</i> |                                             |                  |
| Nelson Reservoir                         | 1994/2006                                   | No               |
| <i>West Fork Little Colorado River</i>   |                                             |                  |
| West Fork at Greer                       | 2006/2006                                   | Yes              |
| West Fork at Sheeps Crossing             | ?                                           | Yes              |
| River Reservoir                          | 2006/2006                                   | Yes              |
| <i>Middle Verde River</i>                |                                             |                  |
| Middle Verde River                       | 2004/2006                                   | Yes              |

#### Conservation measures included in the proposed action

AGFD shall work with the ASNF to evaluate impacts to physical and biological features of designated critical habitat on the West Fork Little Colorado River from anglers accessing the stocking sites at Greer and Sheeps Crossing (non-mandatory measure).

## STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

*Listing*

The southwestern willow flycatcher was listed as endangered, without critical habitat on February 27, 1995 (USFWS 1995b). Critical habitat was later designated on July 22, 1997 (USFWS 1997b). A correction notice was published in the Federal Register on August 20, 1997 to clarify the lateral extent of the designation (USFWS 1997c).

On May 11, 2001, the 10<sup>th</sup> circuit court of appeals set aside designated critical habitat in those states under the 10<sup>th</sup> circuit's jurisdiction (New Mexico). The FWS decided to set aside critical habitat designated for the southwestern willow flycatcher in all other states (California and Arizona) until it could re-assess the economic analysis.

On October 19, 2005, the FWS re-designated critical habitat for the southwestern willow flycatcher (USFWS 2005b). A total of 737 river miles across southern California, Arizona, New Mexico, southern Nevada, and southern Utah were included in the final designation. The lateral extent of critical habitat includes areas within the 100-year floodplain.

A new proposal for critical habitat was published in the Federal Register on August 15, 2011 (USFWS 2011c). The proposal included the designated critical habitat on the West Fork Little Colorado River but did not include the East Fork Little Colorado River. The designated Verde River segment was also included; however the upstream boundary was adjusted north. The new PBFs are similar to the ones from 2005 (USFWS 2005b).

A final recovery plan for the southwestern willow flycatcher was signed by the FWS Region 2 Director and released to the public in March, 2003 (USFWS 2002b). The Plan describes the reasons for endangerment, current status of the flycatcher, addresses important recovery actions, includes detailed issue papers on management issues, and provides recovery goals. Recovery is based on reaching numerical and habitat related goals for each specific Management Unit established throughout the subspecies range and establishing long-term conservation plans (USFWS 2002b).

*Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the southwestern willow flycatcher. This information was taken from the recovery plan (USFWS 2002b). Information in that document is incorporated by reference.

*Life history*

The southwestern willow flycatcher is a small grayish-green passerine bird (Family Tyrannidae) measuring approximately 5.75 inches. The song is a sneezy “fitz-bew” or a “fit-a-bew”, the call is a repeated “whitt”. It is one of four currently recognized willow flycatcher subspecies

(Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Gwynne 1989, Howell and Webb 1995). The historical breeding range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

Flycatchers arrive in the United States beginning in May and a few may still be present in September. Males sing to establish territories and attract a female. The female selects the nest site within the territory and builds the nest. Generally one nesting attempt is made in a season.

Flycatchers are insectivorous, taking prey on the wing or gleaning from vegetation. They can exploit a wide array of arthropod taxa which gives them flexibility in foraging across a season. Terrestrial insects such as bees, wasps, ants, and true flies are particularly important.

### Habitat

The southwestern willow flycatcher breeds in dense riparian habitats from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado. Historical egg/nest collections and species' descriptions throughout its range describe the southwestern willow flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips et al. 1964, Hubbard 1987, Unitt 1987, San Diego Natural History Museum 1995). Currently, southwestern willow flycatchers primarily use Geyer willow (*Salix geyeriana*), coyote willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), boxelder (*Acer negundo*), saltcedar (*Tamarix* sp.), Russian olive (*Elaeagnus angustifolius*), and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include: buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge et al. 2010).

The flycatcher's habitat is dynamic and can change rapidly: nesting habitat can grow out of suitability; saltcedar habitat can develop from seeds to suitability in five years; heavy runoff can remove/reduce habitat suitability in a day; or river channels, floodplain width, location, and vegetation density may change over time. The flycatcher's use of habitat in different successional stages may also be dynamic. For example, over-mature or young habitat not suitable for nest placement can be occupied and used for foraging and shelter by migrating, breeding, dispersing, or non-territorial southwestern willow flycatchers (McLeod et al. 2005, Cardinal and Paxton 2005). Flycatcher habitat can quickly change and vary in suitability, location, use, and occupancy over time (Finch and Stoleson 2000).

Tamarisk is an important component of the flycatcher's nesting and foraging habitat in Arizona and other parts of the bird's range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in a tamarisk tree (Smith et al. 2002). Tamarisk

had been believed by some to be a habitat type of lesser quality for the southwestern willow flycatcher, however comparisons of reproductive performance (USFWS 2002b), prey populations (Durst 2004) and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference (Sogge et al. 2005).

The introduced tamarisk leaf beetle was first detected affecting tamarisk within the range of the southwestern willow flycatcher in 2008 along the Virgin River in St. George, Utah. Initially, this insect was not believed to be able to move into or survive within the southwestern United States. Along this Virgin River site in 2009, 13 of 15 flycatcher nests failed following vegetation defoliation (Paxton et al. 2010). As of 2010, the beetle has now been found in southern Nevada/Utah and northern Arizona within the flycatcher's breeding range. Because tamarisk is a component of about 50 percent of all known flycatcher territories (Durst et al. 2008), continued spread of the beetle has the potential to significantly alter the distribution, abundance, and quality of suitable flycatcher nesting habitat.

#### Current distribution

There are currently 288 known southwestern willow flycatcher breeding sites in California, Nevada, Arizona, Utah, New Mexico, and Colorado (all sites from 1993 to 2007 where a territorial flycatcher has been detected) holding an estimated 1,299 territories (Durst et al. 2008) (Table 17). It is difficult to arrive at a grand total of flycatcher territories since not all sites are surveyed annually. Numbers have increased since the bird was listed and some habitat remains unsurveyed; however, after nearly a decade of intense surveys, the existing numbers are just past the upper end of Unitt's (1987) estimate of 20 years ago (500-1000 pairs). About 50 percent of the 1,299 estimated territories (Table 16) throughout the subspecies range are located at four general locations (Cliff/Gila Valley – New Mexico, Roosevelt Lake - Arizona, San Pedro River/Gila River confluence – Arizona, Middle Rio Grande, New Mexico).

Table 17. Estimated rangewide population for the southwestern willow flycatcher based on 1993 to 2007 survey data for Arizona, California, Colorado, New Mexico, Nevada, Utah, and Texas<sup>1</sup>.

| State      | Number of sites with WIFL territories 1993-07 <sup>2</sup> | Percentage of sites with WIFL territories 1993-07 | Number of territories <sup>3</sup> | Percentage of total territories |
|------------|------------------------------------------------------------|---------------------------------------------------|------------------------------------|---------------------------------|
| Arizona    | 124                                                        | 43.1 %                                            | 459                                | 35.3 %                          |
| California | 96                                                         | 33.3 %                                            | 172                                | 13.2 %                          |
| Colorado   | 11                                                         | 3.8 %                                             | 66                                 | 5.1 %                           |
| Nevada     | 13                                                         | 4.5 %                                             | 76                                 | 5.9 %                           |
| New Mexico | 41                                                         | 14.2 %                                            | 519                                | 40.0 %                          |
| Utah       | 3                                                          | 1.0 %                                             | 7                                  | 0.5%                            |
| Texas      | ?                                                          | ?                                                 | ?                                  | ?                               |
| Total      | 288                                                        | 100 %                                             | 1,299                              | 100 %                           |

<sup>1</sup>Durst *et al.* 2008.

<sup>2</sup>Site boundaries are not defined uniformly throughout the bird's range.

<sup>3</sup> Total territory numbers recorded are based upon the most recent years survey information from that site between 1993 and 2007.

While numbers have significantly increased in Arizona (145 to 459 territories from 1996 to 2007) (English *et al.* 2006, Durst *et al.* 2008), overall distribution of flycatchers throughout the state has not changed much. Currently, population stability in Arizona is believed to be largely dependent on the presence of two large populations (Roosevelt Lake and San Pedro/Gila River confluence). Therefore, the result of catastrophic events or losses of significant populations either in size or location could greatly change the status and survival of the bird. Conversely, expansion into new habitats or discovery of other populations would improve the known stability and status of the flycatcher.

### Threats

Threats to the species and its habitat are identified in the final rule (USFWS 1995b) and in the recovery plan (USFWS 2002b). These include degradation and loss of native riparian vegetation due to stream channelization, stream dewatering due to construction of dams, surface diversions or groundwater pumping, conversion of floodplains that once supported riparian habitats to agricultural or other development activities, creation of hydrological conditions that do not allow for replacement of riparian areas lost to other causes, the expansion of nonnative plants such as Russian olive and tamarisk, improper livestock management, and fire. Flycatchers are also affected directly through increases in brood parasitism due to increased cowbird presence at

agricultural and urbanized areas. Recreation was also identified as a threat, particularly as riparian areas offer shade and opportunities for water based recreation, including angling. Effects of recreational access include reduction in vegetation through trampling, wood cutting, prevention of seedling establishment through soil compaction, bank erosion, creation of trails and paths that fragment the habitat and may alter essential microclimates, and open areas to greater access by predators and competitors. These effects are detailed in Appendix M of the recovery plan (USFWS 2002b) and are incorporated here by reference.

Activities continue to adversely affect the distribution and extent of all stages of flycatcher habitat throughout its range (development, urbanization, grazing, recreation, native and nonnative habitat removal, dam operations, river crossings, ground and surface water extraction, etc.). Introduced tamarisk eating leaf beetles were not anticipated to persist within the range of the southwestern willow flycatcher. However, they were detected within the breeding habitat (and designated critical habitat) of the flycatcher in 2008 along the Virgin River near the Town of St. George, Utah. In 2009, beetles were also known to have been detected defoliating habitat within the range of flycatcher habitat in southern Nevada, and along the Colorado River in the Grand Canyon and near Shiprock in Arizona. Stochastic events also continue to change the distribution, quality, and extent of flycatcher habitat.

#### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the flycatcher recovery plan.

Conservation actions associated with some consultations and Habitat Conservation Plans (Roosevelt and Horseshoe-Bartlett HCPs) have helped to acquire lands specifically for flycatchers on the San Pedro, Verde, and Gila rivers in AZ and the Kern River in CA. Additionally, along the lower Colorado River, the U.S. Bureau of Reclamation is currently attempting to establish riparian vegetation to expand and improve the distribution and abundance of nesting flycatchers. A variety of Tribal Management Plans in CA, AZ, and NM have been established to guide conservation of the flycatchers. Additionally, during the development of the critical habitat rule, management plans were developed for some private lands along the Owens River in CA and Gila River in NM. These are a portion of the conservation actions that have been established across the subspecies' range.

#### *Critical habitat*

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in

the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species' eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (see p. 4-34, U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

The draft rule for critical habitat (USFWS 2004b) described in detail the process by which critical habitat units were identified, relying heavily on the management guidance given in the Recovery Plan (USFWS 2002b). All critical habitat reaches were evaluated by their occupancy and the future ability of the area to support flycatchers, with particular consideration to the dynamic nature of riparian habitat parameters over time, but did not describe the baseline conditions present at the time of designation. Thus, the physical or biological conditions present at each critical habitat reach at the time of designation were not detailed; however, the critical habitat unit was identified as having features to develop breeding habitat. The need for special management of critical habitat to protect against adverse effects due to recreational impacts was also identified in the final rule. For this analysis, we shall assume that any significant effects to the PBFs of critical habitat could result in a loss of conservation value for that critical habitat unit.

The primary constituent elements of critical habitat are based on riparian plant species, structure and quality of habitat and insects for prey. A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (USFWS 2005b). The primary constituent elements are:

1. Riparian habitat in a dynamic successional riverine environment (for nesting, foraging, migration, dispersal, and shelter) that comprises:
  - a. Trees and shrubs that include, but are not limited to, willow species, box elder, tamarisk, Russian olive, cottonwood, stinging nettle, alder, ash, poison hemlock, blackberry, oak, rose, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut.
  - b. Dense riparian vegetation with thickets of trees and shrubs ranging in height from 2 to 30 meters (m) (6 to 98 feet (ft.)). Lower-stature thickets (2 to 4 meters or 6 to



13 feet tall) are found at higher elevation riparian forests, and tall-stature thickets are found at middle- and lower-elevation riparian forests;

- c. Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub level, or as a low, dense tree canopy;
  - d. Sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (*i.e.*, a tree or shrub canopy with densities ranging from 50 percent to 100 percent); or
  - e. Dense patches of riparian forests that are interspersed with small openings of open water or marsh, or shorter/sparser vegetation that creates a mosaic that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac).
2. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, including: flying ants, wasps, and bees; dragonflies; flies; true bugs; beetles; butterflies/moths and caterpillars; and spittlebugs.

A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (USFWS 2005b).

The 2011 proposed rule for critical habitat contained PBFs and Primary Constituent Elements (PCEs) similar to those in 2005 and are listed below:

PCE 1: *Riparian vegetation*. Riparian habitat in a dynamic river or lakeside, natural or manmade successional environment (for nesting, foraging, migration, dispersal, or shelter) that is comprised of trees and shrubs (that can include Gooddings willow, coyote willow, Geyers willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of:

- (a) Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 m to 30 m (about 6 to 98 ft). Lower-stature thickets (2 to 4 m or 6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle- and lower-elevation riparian forests; and/or
- (b) Areas of dense foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only as the shrub or tree level as a low, dense, canopy; and/or
- (c) Sites for nesting that contain a dense (about 50 percent to 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground); and/or
- (d) Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac); and

PCE 2: *Insect prey populations.* A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Onodonta); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

#### *Past consultations*

Section 7 consultations on southwestern willow flycatcher include programmatic efforts for Forest Land Management Plans that address watershed management and multiple uses (livestock grazing, timber harvest, recreation, and other issues), and more site-specific efforts that are more focused on implementing site-specific projects such as highway bridges, vegetation removal, flood protection, and other types of projects. Biological opinions on actions potentially affecting southwestern willow flycatcher in Arizona may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

The stocking sites potentially affecting flycatchers and their critical habitat are in three disjunct locations; the middle Verde River, Nutrioso Creek, and the West Fork Little Colorado River. These action areas were established based on the location of the stocking sites and the adjacent areas where stocked fish are likely to move from the stocking sites such that anglers may be pursuing them. Rainbow trout and Apache trout are the species proposed for stocking at the sites.

The effects of the proposed stocking actions at the middle Verde River and Nutrioso Creek are very limited and will be evaluated first. The effects at the West Fork Little Colorado River sites are more significant.

#### *Middle Verde River*

The proposed action is the stocking of 30,000 rainbow trout at five locations along the middle Verde River at several times from November through March.

### **Description of the Action Area**

The middle Verde River action area encompasses the stocking reach from the Pecks Lake Diversion Dam to the confluence with West Clear Creek. Most of this stocking reach is in designated critical habitat and all is in the proposed critical habitat.

#### **A. Status of the species and critical habitat within the action area**

Flycatchers are present in the middle Verde River area during their breeding season. Much of the Verde River through this reach is in private ownership and not surveyed, so there are likely additional nesting territories present. Several survey points to assess presence of flycatchers were used in the period between 1994 and 2006. Two of those sites, Tavasci Marsh and Tuzigoot Bridge, are at the upper end of the stocking reach near Clarkdale. Flycatchers were last documented at Tavasci Marsh in 1997 and at Tuzigoot Bridge in 1996. The Camp Verde site is above the confluence with Wet Beaver Creek and has supported flycatchers in eight years of survey record, with a maximum of 10 and a minimum of two territories during that period (Ellis et al. 2008). No flycatchers were detected in this vicinity in 2006 but were at Camp Verde in 2010. Flycatchers were also documented in 2005 near the confluence of West Clear Creek. The number of territories declined over the period of record; no indication of the cause was given in reports.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

The designated critical habitat reach extends from two miles above the Highway 89A/260 crossing of the Verde River down to Beasley Flat, with the exception of the Yavapai-Apache Tribal lands. The proposed critical habitat extends further upstream than the designated reach, extending past the Tapco Diversion Dam. The middle Verde River flycatcher habitat is affected by water diversions, urban and agricultural development, recreation, brood parasitism, and other threats as described in the final rule (USFWS 1995) and recovery plan (USFWS 2002b). These actions have affected the amount of riparian habitat available for the flycatcher and the quality of such habitat.

### **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with

that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

The proposed stocking actions would take place when flycatchers are not present along the middle Verde River. Some rainbow trout may persist in the river and be sought by anglers up to June, which is after the May arrival of breeding flycatchers. The amount of such angling is likely to be low, as the water temperatures are less conducive to rainbow trout survival during the summer months. Migrating flycatchers are able to use a variety of habitats, all of which are available along the river corridor, and the presence of anglers at the limited fishing access locations will not cause meaningful disturbance to migrants. Breeding birds select dense habitat areas that are generally not easily accessed, and anglers are unlikely to move through these areas instead of using existing access routes. The amount of such disturbance is limited by the difficulty of access, the short duration of the disturbance period related to trout anglers, the tolerance of flycatchers to low levels of disturbance that is not near the nest, and the likely rarity of occurrence of disturbing events. These effects are insignificant.

Effects are unlikely to critical habitat that would alter conditions existing at the time of designation from the continuing use of existing access points along the river to pursue stocked sportfish. Angler access would be during the period when riparian trees are dormant, and post-flowering seed germination and seedling development would be more likely to occur at the end of or after the stocking season when angler use for stocked rainbow trout is reduced. Because of the seasonality of the fishery, anglers are less likely to be in the riparian areas to damage riparian tree seedlings during the prime growing season for understory shrubs and the cottonwoods and willows used by the flycatcher, thus minimizing effects to maintaining or replacing stands of riparian vegetation. Further, the limited access areas are a minor portion of the designated critical habitat reach, and, as these are habitually used by recreationists in all seasons, may already be limited in their conservation value. Rainbow trout were stocked in the Verde River at the time of designation, and the continuation of rainbow trout stocking is not likely to alter the existing condition, or, preclude management actions to restore these areas where anglers access the river to pursue stocked trout, so the ability of the designated or proposed critical habitat unit to support breeding habitat is maintained. These effects are insignificant and do not diminish the conservation value of the critical habitat.

## CUMULATIVE EFFECTS

The Verde River is a mix of federal, tribal, state and private land. Development on private lands is expected to continue into the future.

### *Nelson Reservoir*

The proposed action is the stocking of 20,000 rainbow trout annually at the lake several times from April through July.

**Description of the action area**

The Nutrioso Creek action area is Nelson Reservoir, and there is no critical habitat at this site.

**A. Status of the species within the action area**

Flycatcher surveys have been done at Nelson Reservoir in 12 years from 1993 through 2006. Only one flycatcher territory was reported in 1994, and the lone bird did not find a mate. There is no critical habitat at this site.

**EFFECTS OF THE ACTION**

Flycatchers have not been detected recently at this site. However, should a flycatcher arrive to use the available habitat at the upper end of the lake, anglers are unlikely to be using the area due to lack of access and the difficulty in fishing due to the extensive vegetation. Anglers would not likely be able to disturb nesting flycatchers, or cause any damage to habitat.

**CUMULATIVE EFFECTS**

Nelson Reservoir is a privately owned water storage reservoir. We anticipate that operations at the reservoir are unlikely to change in the near future.

*West Fork Little Colorado River*

The proposed action is the stocking of 35,000 Apache and/or rainbow trout at the stocking site along the West Fork and East Fork at Greer at several times from May through September, and 12,000 Apache trout at the Sheeps Crossing site several times from May through September.

**Description of the action area**

The West Fork Little Colorado River action area is the West Fork from the upstream limit of the critical habitat down to the end of the critical habitat reach and the East Fork from its confluence with the West Fork upstream to the Sheeps Crossing stocking site.

**A. Status of the species and critical habitat within the action area**

There are three survey sites in the stocking reaches; at Greer Townsite, at Sheeps Crossing and at River Reservoir. The Greer Townsite location has a survey history from 1993 through 2006. The last documented nest at a territory was in 2000, with two separate adults setting up two territories in 2006. Neither territory produced a nest. The Sheeps Crossing site has a survey history from 1994 through 2003 and no flycatchers were detected on any survey. The River Reservoir site has a survey history from 1993 through 2006 with nesting flycatchers in one to nine territories found in eight years, most recently in 2006 (Ellis et al. 2008). There may be other active territories in the upper Little Colorado River drainage; however, surveys have not been conducted throughout the drainage and, not since 2006, at the known sites under consideration here.

Critical habitat was designated for the East Fork (from Forest Road 113 downstream to the confluence with the West Fork) and West Fork (from 0.5 miles above Forest Road 113 downstream to a diversion ditch below the South Fork of the Little Colorado River) and including River Reservoir). The proposed critical habitat does not include the East Fork of the Little Colorado River or River Reservoir adjacent to the West Fork. The important considerations for this unit of critical habitat include the need for special management to protect against adverse effects due to recreational impacts was identified in the final rule.

The PBFs of this critical habitat unit may have been adversely affected by the 2011 Wallow Fire which burned in the East and West Forks' drainages, most particularly in the East Fork. While the critical habitat itself may not have burned, the changes in runoff patterns over the burned watershed may cause sedimentation or erosion in the streams that affect the existing riparian vegetation or the ability of new vegetation to establish. The magnitude of the current effects to the critical habitat reach is not known, and additional effects may occur based on future runoff events until the watershed stabilizes.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

The critical habitat reaches are on a mix of Apache-Sitgreaves National Forest, private, and a small amount of state land at the lowest end. Land management activities in the action area include managed livestock grazing, road construction and maintenance, urban and rural uses including small commercial, municipal, and residential development and agriculture. Recreation is an important component of the land use, with fishing and hiking popular pursuits. The Apache-Sitgreaves National Forest Forest Management Plan guides Federal land management activities that can affect the river corridors.

The recent reconstruction of forest highway (FH) 43 (previously named forest road 113) had effects to critical habitat on the East and West Forks of the Little Colorado River. Replacement of the existing bridge over the East Fork resulted in improved hydrologic functioning through enhanced flow passage. Approximately 35 acres of critical habitat below the bridge was fenced to exclude elk to allow the willow communities to recover. Recreationists on horseback were also excluded by the fencing. This area is outside of the stocking reach.

On the West Fork, the FH 43 Bridge at Sheeps Crossing was relocated 328 feet downstream and a portion of the existing railroad embankment was removed and the stream channel restored. This allowed for enhanced flows through this reach and restoration of the stream meanders and replanting with willows provided benefits to the PBFs. In addition, the old roadbed to the existing bridge was converted to a universal access trail with a drop-off loop with only two handicap access parking spots near the new bridge. This eliminated the old parking lot at the old bridge crossing. All recreation access for fishing or picnicking along the West Fork above the new bridge is now by foot only. Trail access to Mount Baldy along the West Fork remained unchanged. It is uncertain how much the change in access to the Sheeps Crossing fishing site will have on the amount or type of use the area receives.

Recreation, combined with livestock and elk grazing, are the primary stressors on critical habitat

in the action area. Livestock grazing is managed under approved allotment management plans, however, monitoring of forage utilization and impacts are inconsistent (*Forest Guardians v. Johanns* 450F.3d 455 {9<sup>th</sup> Circuit 2006}). Elk are managed through state game management plans; however those plans address numbers of elk, not how they use the landscape for grazing. The Greer area is a popular summer destination, and a recent land exchange will allow more development in the area on what was Forest Service land adjacent to a private tract west of Greer. The West Fork Trail parallels a portion of the West Fork up to Sheeps Crossing, where the trail becomes the West Fork Mount Baldy Trail, one of the most used hiking trails on the Forest (ASNF 2010). Other trails come up portions of the East Fork, and there is some development along the lower portion of that fork with associated human uses. We believe the aggregate effects past land management activities and ongoing recreational uses are responsible for the present status of flycatchers and their critical habitat in the action area.

## EFFECTS OF THE ACTION

The summer season of high recreational use in the action area overlaps with the flycatcher breeding season and with the period of growth and seedling for the riparian trees and shrubs. The dense habitat occupied by nesting flycatchers is difficult to move through, and access along the river is likely through more open areas or using existing trails or paths through the denser vegetation areas. Access to flycatcher critical habitat at River Reservoir is unlikely, as it is mostly in the upper end of the reservoir where there is limited shore access and most anglers in that part of the lake are in boats and are unlikely to be close enough to disturb nesting flycatchers or cause effects to critical habitat.

The critical habitat reach along the East Fork and West Fork is likely to be accessed at various points along the reach, since stocking is done on both Forks and in the Sheeps Crossing area. The entire critical habitat reach is not in the stocking reach; however, anglers may access more areas outside the stocking site as trout may move out of the reach. The stocking reach for the Greer section is 2.7 miles of the lower East Fork and West Fork, and 0.5 miles at Sheeps Crossing. The total critical habitat reach is at least 25 miles, so approximately 12 to 15 percent of the critical habitat may be affected by anglers. Effects to critical habitat could be a decrease in the ability of the area to regenerate (due to loss of seedlings to trampling and reduced seedling establishment due to compacted soils), the loss of the ground-level vegetation layer and continued fragmentation of vegetation patches. Effects to the PBFs may be compounded by the facts that these upper elevation riparian areas have a shorter growing season that corresponds with the angler use season so damage to vegetation occurs during the growing season, and that these willows are shorter and more shrub-like than lower elevation willow species, with dense foliage from the ground up. Human movements through these areas can reduce the amount of foliage within five to six feet of the ground through breakage of branches. Anglers with cumbersome equipment may be less likely to venture into dense vegetation, but may use trails initially broken by other recreationists.

As noted previously, surveys from 1993 through 2006 (there are no more recent surveys) did not find any nesting or migrant flycatchers at Sheeps Crossing with the last territory at Greer in 2000 with one migrant in 2001, two unknown flycatchers detected in 2002, and two separate males set up territories in 2006 but did not nest. The Greer site had a maximum of five territories in 1997,

with the numbers declining after that. Trout stocking at these sites was initiated long before flycatchers were listed; and changes in stocking rates or management since that time are reflected in the change from rainbow trout to Apache trout, but it remains a high-intensity put-and-take fishery. We are unable to say that angler-related disturbance was a factor in the reduction of flycatcher nesting since 1997; particularly since the survey record for 1993-1995 did not have any flycatcher occupancy. The first territories were documented in 1996 with the last in 2000. Recreational use of the river corridor in general may be a contributing factor in flycatchers no longer using the site.

Published information from these surveys did not present habitat information. It is unknown if this change in number of territories over time represents a true decline in flycatcher numbers, the result of natural maturation of habitat conditions that reduce habitat suitability for flycatchers, or due to continuing degradation of habitat due to human access issues. The condition of the critical habitat in the Greer area stocking reach is unknown but as we have noted, receives heavy recreational use. The riparian area along the Sheeps Crossing area is in an area with developed recreational facilities has been significantly degraded by recreationists hiking the trails and angling as well as other activities. The amount of recreational use of this area is heavy enough that trapping efforts for New Mexico meadow jumping mouse in that area were cancelled due to the inability to conceal traps from view, part of which related to the degradation of the herbaceous vegetation layer due to trampling and soil compaction. The Greer area is fairly inaccessible due to boggy conditions; however, there are hiking trails along the river that flank or pass through portions of the riparian corridor.

The baseline condition of PBFs of critical habitat in the action area is not documented in the final rule, so we have limited information to address any changes since 2005 that may reflect degradation by anglers pursuing stocked sportfish, particularly in light of the recent Wallow Fire which may have affected PBFs in a portion of the critical habitat. PBFs related to riparian regeneration, maintenance of dense vegetation layers from the ground up into the shrub-tree canopy, and habitat fragmentation by trails are affected by recreational use of the river corridor. Whether these conditions have changed due to natural successional processes since designation is unknown; and rainbow trout stocking was ongoing in these locations at the time of the designation, so the effects of anglers is not additive since designation. The recent conservation measures taken in association with the realignment of FH 43 at Sheeps Crossing may improve the quality of critical habitat at that site over time. Without the appropriate physical conditions in the riparian vegetation, the conservation value of critical habitat for flycatchers is diminished. The amount of critical habitat at risk from anglers is a small amount of the total, and, the location where flycatchers continue to establish territories is not affected by angling, so the overall conservation value of critical habitat is not significantly reduced.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.



Lands within the action area that are part of the Apache-Sitgreaves National Forest are subject to additional section 7 consultation. Activities on the private lands at Greer are not, and we anticipate those to continue into the future. Additional development on the newly exchanged lands to the west is expected over the next 10 years, which is likely to increase the amount of recreational activity along the East and West Forks. That increase may affect PBFs of critical habitat to some degree in the areas currently experiencing recreational use.

## CONCLUSION

After reviewing the current status of the flycatcher and its critical habitat, the environmental baseline for the action area, the effects of the proposed sportfish stocking and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the flycatcher, and is not likely to destroy or adversely modify designated critical habitat.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

We present this conclusion on the flycatcher for the following reasons:

- Adverse effects to flycatchers and critical habitat at the middle Verde River are unlikely to occur due to season of use and limited access to the river within the critical habitat reach.
- Adverse effects to flycatchers at Nelson Reservoir are unlikely to occur since the species is apparently not present; however, if it was, the area likely used is not where anglers would be accessing the lake.
- Anglers are unlikely to access the River Reservoir nesting areas, so flycatchers there are not likely to be disturbed. There may be some disturbance of flycatchers attempting to set up territories near Greer related to anglers accessing the habitat. The amount of this disturbance is unknown, but is not likely of itself to preclude use of the wider habitat area where angler access is not occurring.
- The amount of critical habitat potentially degraded by angler access is approximately 15 percent of the total. Recreational use of all types has had effects to these areas in the past that continue into the future. The ability of the critical habitat at West Fork Little Colorado River to provide the PBFs at the time of designation compared to the present time may or may not have declined significantly; however, the proposed action may not allow habitat components to improve in some specific locations. This does not appreciably diminish the value of the entire critical habitat unit for either survival or conservation of the species. The overall area likely continues to provide PBFs, so the conservation value of the habitat as a whole is maintained.

The conclusions of this biological opinion are based on full implementation of the project as

described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Verde River: Angler access to current nesting areas during the breeding season is not likely to occur at the middle Verde River due to the seasonal nature of the fishery. Thus, the first condition is not met. Further, the riparian vegetation is dormant for much of that time, so effects to habitat are limited in extent. The second condition is not met.
- East and West Fork Little Colorado River: At River Reservoir and portions of the East Fork and West Fork at Greer, the occupied habitats are not likely to be accessed by anglers due to dense vegetation, boggy conditions, or other physical features of flycatcher habitats. The opportunity for anglers to come into contact with migrating or nesting flycatchers is low and we do not believe it occurs to any measurable level. The first condition is not met. Along the West Fork at Sheeps Crossing, the current habitat conditions and level of recreational use likely preclude development of nesting flycatcher habitat within the stocking reach, so nesting flycatchers are not likely to be present. Improvement of habitats above and below the railway embankment may, over time, establish suitable habitat there, but this is uncertain. We cannot be reasonably certain that anglers are the cause of this habitat degradation, so the second condition is not met.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for flycatcher contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery actions for flycatchers under the auspices of the CAMP provides conservation benefits to flycatchers that may not be otherwise realized.
2. We recommend that surveys for flycatchers, including nest searches, be accomplished annually in the publically owned sections of the action areas. GIS mapping to identify priority survey areas can be accomplished as part of this effort.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### Spikedace (*Meda fulgida*) and critical habitat

#### DESCRIPTION OF THE PROPOSED ACTION

Spikedace may be affected by stocking in the Verde watershed, San Francisco River, and Tonto Creek. Designated and proposed critical habitat may also be affected (Table 18). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. Proposed critical habitat is indicated by a (P).

Table 18: Stocking sites, sportfish species proposed for stocking, and potentially affected spikedace populations and/or designated or proposed critical habitat

| <b>Stocking complex/site</b> | <b>Species to be stocked</b> | <b>Spikedace population affected</b> | <b>Critical habitat unit affected</b> |
|------------------------------|------------------------------|--------------------------------------|---------------------------------------|
| <i>San Francisco River</i>   |                              |                                      |                                       |
| Luna Lake                    | ONMY, ONCL                   | San Francisco River                  | San Francisco River (P)               |
| <i>Verde River</i>           |                              |                                      |                                       |
| Goldwater Lake               | ONMY, LEMA, PONI, MISA       | Upper Verde River                    | Granite Creek (P), Verde River(P)     |
| Watson Lake                  | ONMY*, LEMA, PONI            | Upper Verde River                    | Granite Creek (P), Verde River(P)     |

|                     |                   |                   |                                                  |
|---------------------|-------------------|-------------------|--------------------------------------------------|
| Willow Springs Lake | ONMY*, LEMA, PONI | Upper Verde River | Granite Creek (P), Verde River(P)                |
| Middle Verde River  | ONMY              |                   | Verde River (P), Fossil Creek (P)                |
| Oak Creek           | ONMY              |                   | Verde River (P), Oak Creek (P)                   |
| Wet Beaver Creek    | ONMY              |                   | Verde River (P), Beaver and Wet Beaver Creek (P) |
| Green Valley Lake   | ONMY              |                   | Verde River (P), Fossil Creek (P)                |
| <i>Tonto Creek</i>  |                   |                   |                                                  |
| Tonto Creek         | ONMY              |                   | Tonto Creek and tribs (P)                        |
| Christopher Creek   | ONMY              |                   | Tonto Creek and tribs (P)                        |
| Haigler Creek       | ONMY              |                   | Tonto Creek and tribs (P)                        |

#### Conservation measures included in the proposed action

AGFD shall continue monitoring of the Upper Verde River to evaluate native and nonnative fish populations. Any individuals of the stocked sportfish species captured during such monitoring will be removed from the river. This measure will be implemented following the established schedule of once every three years.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission (AGFC) for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

Spikedace was listed as a threatened species on October 28, 1986 (USFWS 1986b). Although it is currently listed as threatened, the FWS determined in 1994 that a petition to uplist the species to endangered status is warranted (USFWS 1994b). The FWS confirmed this decision in 2000 (USFWS 2000). A reclassification proposal to list the species as endangered was published with the latest critical habitat proposal on October 28, 2010 (USFWS 2010d). For the purposes of this

consultation, the spikedace is a threatened species with designated critical habitat, and a species proposed for endangered status with proposed critical habitat.

### Critical habitat

Critical habitat was designated on March 21, 2007 (72 FR 13356) (USFWS 2007c). Critical habitat includes portions of the Verde; middle Gila, lower San Pedro, and upper Gila rivers, and Aravaipa Creek, as well as several tributaries of those streams. Following a legal challenge to that designation, we filed a motion for voluntary remand and are currently re-evaluating critical habitat. However, those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized in October 2011. The new critical habitat proposal was published on October 28, 2010 (USFWS 2010d). The Spikedace Recovery Plan was signed in 1991 (USFWS 1991b).

### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the spikedace. This information was taken from the 2009 candidate assessment form (USFWS 2009g), and proposed rule for critical habitat and reclassification to endangered (USFWS 2010d). Information in these documents is incorporated by reference.

### Life history

Spikedace is a small silvery fish whose common name alludes to the well-developed spine in the dorsal fin (Minckley 1973). Spikedace spawns from March through May with some yearly and geographic variation (Barber et al. 1970, Anderson 1978, Propst et al. 1986). Actual spawning has not been observed in the wild, but spawning behavior and captive studies indicate eggs are laid over gravel and cobble where they adhere to the substrate. Spikedace live about two years with reproduction occurring primarily in one-year old fish (Barber et al. 1970, Anderson 1978, Propst et al. 1986). It feeds primarily on aquatic and terrestrial insects (Schreiber 1978, Barber and Minckley 1983, Marsh et al. 1989).

Taxonomic and genetic work on spikedace indicates there are substantial differences in morphology and genetic makeup between remnant spikedace populations. Remnant populations occupy isolated fragments of the Gila basin and are isolated from each other. Anderson and Hendrickson (1994) found that spikedace from Aravaipa Creek are morphologically distinguishable from spikedace from the Verde River, while spikedace from the upper Gila River and Eagle Creek have intermediate measurements and partially overlap the Aravaipa and Verde populations. Mitochondrial DNA and allozyme analyses have found similar patterns of geographic variation within the species (Tibbets 1992, Tibbets 1993).

### Habitat use

Spikedace live in flowing water with slow to moderate velocities over sand, gravel, and cobble substrates (Propst et al. 1986, Rinne and Kroeger 1988). Specific habitat for this species consists of shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of

mid-channel sand/gravel bars, and eddies at the downstream riffle edges (Propst et al. 1986).

#### Current distribution

Spikedace historically occurred throughout the mid-elevations of the Gila River drainage, but is currently known only from the middle, and upper Gila River, and Aravaipa and Eagle creeks (Barber and Minckley 1966, Minckley 1973, Anderson 1978, Marsh et al. 1990, Sublette et al. 1990, Jakle 1992, Knowles 1994, Rinne 1999). The species also occurs in the upper Verde River, but appears to be declining in numbers. It has not been documented in the Verde River since 1999 despite annual surveys, and additional survey work is needed to determine its current status.

The status of spikedace is declining rangewide. It is now restricted to approximately 10 to 15 percent of its historical range. Within occupied areas, it is common to very rare, but is presently common only in Aravaipa Creek and some parts of the upper Gila River in New Mexico (USFWS 2000). Although it is currently listed as threatened, the FWS has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal was included in the October 28, 2010 proposed critical habitat.

#### Threats

Threats to spikedace were summarized in the 2009 Species Assessment and Listing Priority Assignment Form for the annual Candidate Notice of Review (U.S. Fish and Wildlife Service 2009g). Habitat destruction along with competition and predation from introduced nonnative species are the primary causes of the species decline (Miller 1961, Williams et al. 1985, Douglas et al. 1994). Threats include loss of habitat due to groundwater pumping, surface water diversions, impoundments, improperly managed livestock grazing, wildfire, land conversion for mining, agriculture or urban developments, and the introduction of nonnative invertebrates, amphibians, and fish that compete with, prey on, or transmit novel parasites or diseases to spikedace.

#### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of the (species) recovery plan.

Ongoing conservation actions for the spikedace are provided by the Central Arizona Project Gila River Basin Native Fishes Conservation Program (CAP Program). The CAP Program is federally funded and implements surveys and monitoring, barrier construction with subsequent renovations to remove nonnative fish species and stocking of spikedace and other native species, and collection of spikedace for hatchery-rearing to provide individuals for repatriation. Stocking of spikedace into Fossil Creek (a tributary of the Verde River), Muleshoe Ecosystem sites, and Bonita Creek have proceeded under the Program. Stocking of spikedace into the San Francisco River near Glenwood, New Mexico was initiated in 2008. Spikedace are also a covered species under the Horseshoe-Bartlett HCP (SRP 2008).

*Critical habitat*

“Critical habitat,” as defined in Section 3(5)(A) of the Act, means: (i) the specific areas within the geographical area occupied by the species at the time it is listed, on which are found those physical and biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary that such areas are essential for the conservation of the species. The term “conservation,” as defined in Section 3(3) of the Act, means: the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered and threatened species). In this context, critical habitat preserves options for a species’ eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether or not the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (USFWS and NMFS 1998). To determine this, we analyze whether the proposed action will adversely modify any of those physical or biological features (PBFs) that were the basis for determining the habitat to be critical. To determine if an action results in an adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat units, and the PBFs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

For spikedace, the role of each critical habitat unit in recovery was not defined in the recovery plan. For this analysis, we shall assume that any significant effects to the PBFs of critical habitat could result in a loss of conservation value for that critical habitat unit.

## 2007 Designation

When critical habitat was designated in 2000 and 2007 (USFWS 2000, 2007c), the USFWS determined the primary constituent elements (PBF) for spikedace. PBFs include those habitat features required for the physiological, behavioral, and ecological needs of the species. For spikedace, these include:

1. Permanent, flowing water with no or low levels of pollutants (Baker 2005), including living areas with appropriate flow velocities and depths for the various life stages of the fish, as follows (Table 19):

Table 19: Flow velocities and depths for life stages of spikedace

| PBF             | Life stage of spikedace | Parameter                  |
|-----------------|-------------------------|----------------------------|
| Flow velocities | Adult                   | 20 and 60 cm/second (8 and |

|       |          |                               |
|-------|----------|-------------------------------|
|       |          | 24 in/second)                 |
|       | Juvenile | 18 cm/sec (8 in/sec)          |
|       | Larval   | 10 cm/sec (4 in/sec)          |
| Depth | Adult    | 10 cm (4 in) and 1 m (40 in)  |
|       | Juvenile | 3 cm (1.2 in) and 1 m (40 in) |
|       | Depth    | 3 cm (1.2 in) and 1 m (40 in) |

Appropriate habitats have shear zones where rapid flow borders slower flow, areas of sheet flow (or smoother, less turbulent flow) at the upper ends of mid-channel sand/gravel bars, and eddies at downstream riffle edges. In addition, water should have dissolved oxygen levels greater than 3.5 cc/l and no or minimal pollutant levels for pollutants such as copper, arsenic, mercury, and cadmium; human and animal waste products; pesticides; suspended sediments; and gasoline or diesel fuels.

2. Sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Suitable levels of embeddedness are generally maintained by a natural, unregulated hydrograph that allows for periodic flooding or, if flows are modified or regulated, a hydrograph that allows for adequate river functions, such as flows capable of transporting sediments.

3. Streams that have low gradients of less than approximately 1.0 percent

4. Water temperatures in the approximate range of 35 to 86 °F (1.7 to 30.0 °C) (with additional natural daily and seasonal variation)

5. Pool, riffle, run, and backwater components;

6. Habitats with an abundant aquatic insect food base consisting of mayflies, true flies, caddisflies, stoneflies, and dragonflies.

7. Habitat devoid of nonnative aquatic species or habitat in which nonnative aquatic species are at levels that allows persistence of spikedeace.

8. Areas within perennial, interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted.

The constituent elements are generalized descriptions and ranges of selected habitat factors that are critical for the survival and recovery of spikedeace. The appropriate and desirable level of these factors may vary seasonally and is highly influenced by site-specific circumstances. Therefore, assessment of the presence/absence, level, or value of the constituent elements must include consideration of the season of concern and the characteristics of the specific location. The constituent elements are not independent of each other and must be assessed holistically, as a functioning system, rather than individually. In addition, the constituent elements need to be assessed in relation to larger habitat factors, such as watershed, floodplain, and streambank conditions, stream channel geomorphology, riparian vegetation, hydrologic patterns, and overall aquatic faunal community structure.



Of the five stream groupings or complexes of critical habitat units designated in 2007 in the rule for loach minnow and spikedace, critical habitat for spikedace was designated in three of the five:

Spikedace likely occupy Complex 1, the Verde River Complex in Yavapai County, Arizona, but at reduced numbers. Designated critical habitat is in the upper Verde River from Sullivan Lake to near Packard Ranch. Recent surveys have failed to locate spikedace in the upper Verde. The last known record is from 1999 (M. Brouder, USFWS, 2002); however, the unit is considered occupied by FWS. Spikedace were stocked into Fossil Creek in 2007, 2008, and were not detected in surveys in 2008, 2009, and 2010. Subsequent to the 2010 surveys, spikedace were again stocked into Fossil Creek, and surveys have not been conducted since that introduction. Other tributary streams to the Verde are believed to be unoccupied at this time.

Complex 3, the Middle Gila/Lower San Pedro/Aravaipa Creek Complex, is occupied by spikedace with its population status ranging from rare to common. Aravaipa Creek supports some of the best and most protected spikedace populations due to special use designations on Bureau of Land Management (BLM) land, substantial ownership by The Nature Conservancy, and planned construction of fish barriers to prevent invasion of nonnative fish species.

Complex 5, the Upper Gila River Complex in Grant, Catron, and Hidalgo counties, New Mexico, is occupied throughout by spikedace, and contains the largest remaining population of spikedace. Because of its remoteness, there is a relatively low degree of habitat threats in this complex.

#### 2010 Proposed Rule

The October 28, 2010, proposed rule for critical habitat included all the designated critical habitat reaches and new sites in several drainages including Complex 2 (Salt River) and Complex 4 (San Francisco River) where no critical habitat was designated in 2007. In the Verde River, critical habitat was proposed for the spikedace on the mainstem from Sullivan Lake to the confluence with Fossil Creek (an extension of the designated critical habitat reach), the lower two miles of Granite Creek above its confluence with the Verde River, 33.7 miles of Oak Creek upstream from its confluence with the Verde River, 20.8 miles of Beaver Creek and Wet Beaver Creek upstream from the Beaver Creek confluence with the Verde River, 6.8 miles of West Clear Creek upstream of its confluence with the Verde River, and 4.7 miles of Fossil Creek from its confluence with the Verde River. Of these proposed critical habitat areas, only the upper Verde River is considered occupied by the species. The Fossil Creek proposed critical habitat unit may contain spikedace if they move out of the stocking reach above the critical habitat boundary.

In Complex 2, in Tonto Creek, critical habitat was proposed for 29.7 miles of Tonto Creek from its confluence with Greenback Creek upstream to Houston Creek, 9.4 miles of Greenback Creek from Tonto Creek up to Lime Springs, 1.8 miles of Rye Creek, 16.9 miles of Spring Creek upstream from Tonto Creek, and 3.6 miles of Rock Creek upstream from Spring Creek. Spikedace are not currently found in these areas.

In Complex 4, in the San Francisco River, proposed critical habitat extends 112.3 miles from the

confluence with the Gila River upstream to the confluence with the Tularosa River. Spikedace were stocked into the San Francisco River near Alma in 2008.

The PBFs for the October 28, 2010, proposed critical habitat for spikedace and loach minnow are:

1. Habitat to support all egg, larval, juvenile, and adult spikedace. This habitat includes perennial flows with a stream depth generally less than 1 m (3.3 ft), and with slow to swift flow velocities between 5 and 80 cm per second (1.9 and 31.5 in. per second). Appropriate stream microhabitat types include glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness. Appropriate habitat will have a low gradient of less than approximately 1.0 percent, at elevations below 2,100 m (6,890 ft). Water temperatures should be in the general range of 8.0 to 28.0 °C (46.4 to 82.4 °F);
2. An abundant aquatic insect food base consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies;
3. Streams with no or no more than low levels of pollutants;
4. Perennial flows, or interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted;
5. No nonnative aquatic species, or levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace;
6. Streams with a natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of transporting sediments

#### *Previous consultations*

Section 7 consultations on spikedace deal with the effects of road and bridge construction and maintenance, grazing, water developments, fire, utilities development and maintenance, species control efforts, restoration of habitat and species, or recreation. There are a high number of consultations for urban development and utilities, however, these projects typically do not result in adverse effects to the species but are for technical assistance only. Small numbers of projects occur for timber, land acquisition, agriculture, sportfish stocking, flooding, Habitat Conservation Planning, native fish restoration efforts, alternative energy development, and mining. Biological opinions on actions potentially affecting spikedace may be found at our website [www.fws.gov/southwest/es/arizona](http://www.fws.gov/southwest/es/arizona) in the Section 7 Biological Opinion page of the Document Library.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental

baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

There are three action areas since there are widely separated stocking sites that have potential for adverse effects to spokedace are part of the proposed action.

### *Verde River*

#### **Description of the action area**

The Upper Verde action area includes the stocking sites that drain into the Verde River from Sullivan Dam downstream to Fossil Creek. This action area encompasses the stocking sites and the hydrologically connected portions of the drainage that may contain stocked sportfish that have moved from the stocking sites via reservoir releases or flood events. Critical habitat for the spokedace is found in this action area.

#### **A. Status of the species and critical habitat within the action area**

Spokedace have not been documented in the upper Verde River since 1999 (U.S. Fish and Wildlife Service 2009). Annual sampling at seven sites in the upper Verde from 1994 through 2008 documented spokedace at all sites in 1994; at five sites in 1995; four sites in 1996, and no sites in 1997 or after (J. Rinne, USFS-RM compiled data). Other native species in the upper Verde, particularly speckled dace and roundtail chub, also showed significant declines. The causes of the decline of the spokedace population and that of other native fish species in the upper Verde River is unclear; however, the expansion of the nonnative fish population (particularly green sunfish, red shiner, and smallmouth bass) was a factor that occurred around the same time of flooding and drought, and changed management practices that influenced the types of habitats present (Rinne 2001, Rinne and Carter 2008, Rinne et al. 1998). The upper Verde River is still considered occupied by spokedace, with the population likely at very low numbers. Spokedace are not believed to be present in the Verde River below the Tapco Diversion Dam

Designated critical habitat in the action area is in Complex 1, and consists of 43 miles of the Verde River from the Prescott and Coconino National Forest boundary with private lands (Packard Ranch) upstream to Sullivan Dam. The designation included the wetted channel of the river and the adjacent floodplains within 300 lateral feet on either side of the bankfull stage. Particular threats requiring special management identified at the time of designation (2007) were nonnative fish species, grazing, and water diversions (USFWS 2007c). The critical habitat was identified as having a number of primary constituent elements, including shear zones, sheet flow, and eddies, and an appropriate prey base. The lateral extent of each segment within this Complex contains PBFs 3 and 5 to provide for one or more of the life history functions of the spokedace. The presence of nonnative fishes compromises the ability of this Complex to meet PBF 7.

Complex 1 is the smallest of the three critical habitat complexes designated for the spokedace, comprising 16 percent of the total area designated. The spokedace population in this Complex is

also the smallest, with no records since 1999. This Complex is important for the conservation of the spokedace, particularly considering the unique genetic lineage of the spokedace found there and that this Complex is in a separate part of the historical range from the upper Gila or San Pedro Complexes, representing somewhat different physical conditions based on the surrounding vegetation community, geological conditions, elevation and weather patterns.

The proposed critical habitat extends further downstream in the mainstem Verde River to the confluence with Fossil Creek and includes the lower reaches of five tributary streams (Granite Creek, Oak Creek, Wet Beaver Creek, West Clear Creek and Fossil Creek). All proposed critical habitat reaches contain PBFs 1 through 4, with Granite Creek and West Clear Creek not supporting PBF 6 at this time. The ability of any of the proposed reaches to support PBF 5 at this time is unknown. All the reaches maintain significant populations of nonnative predatory species.

## **B. Factors affecting the species' environment and critical habitat within the action area**

Spokedace and its designated critical habitat in the action area are affected by groundwater pumping from the aquifer that supports the headwater springs, reduction in flows from Granite Creek due to the presence of the three reservoirs that store water (Goldwater, Watson, and Willow Creek), watershed conditions that influence runoff patterns after storm events, and the presence of nonnative fish species. Most of the nonnative fish species currently found in the upper Verde River were legally introduced elsewhere in the state and either by hydrological connectivity, deliberate, illegal movement or inadvertent transport, were moved to the upper Verde and became established. Efforts to control and manage groundwater use in the basin are ongoing, as are land management activities to enhance watershed conditions. Conservation actions by AGFD and The Nature Conservancy that purchased private lands in the upper portion of the critical habitat reach allows for enhanced management of the riparian areas that are part of the lateral extent of the critical habitat and reduces the risk of introduction of nonnative aquatic species at those sites. The Gila River Basin Native Fishes Recovery Program (CAP Program) is involved with planning for a fish barrier in the reach that would allow the eventual renovation of the upper Verde designated critical habitat reach to remove nonnative species. Nonnative removal efforts at Stillman Lake in 2009 are an example of the types of future conservation actions envisioned.

The proposed critical habitat areas are affected by water diversions, land management activities that affect the watershed, and the presence of nonnative species.

We believe the current status of the spokedace in the action area is the result of past land management actions that affected the watershed and the introduction of nonnative aquatic species.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that

are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the spokedace are in the final rule (USFWS 1986b), the recovery plan (USFWS 1991b), the critical habitat designation (USFWS 2007c), and the 2009 CNOR (USFWS 2009g). All these documents are incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on spokedace and both designated and proposed critical habitat.

Effects of the stocking of sportfish into the Granite Creek reservoirs would occur if stocked fish or their progeny escape from the reservoirs during controlled releases or flood flows and access the upper Verde River. Largemouth bass are of particular concern due to their high level of predation risk to small native fish. Black crappie over 100 millimeters switch from being planktivores to focusing on threadfin shad (Minckley 1973), and thus pose a predation risk to spokedace. Bluegills are not particularly predaceous, but do consume fish larvae or small fishes on occasion (Minckley 1973). Stocked rainbow trout are documented feeding on loach minnow (Propst et al. 1998). The risk of predation by these species on spokedace also must take into account the habitat preferences of the spokedace (shallow riffles with sand, gravel, and rubble substrates and moderate to swift currents and swift pools over sand or gravel substrates) (summarized in USFWS 2009g) versus the slower water pool habitats preferred by the nonnative species. Because habitat use is not absolute, and is also dependent on availability within the system, the potential for exposure remains if the stocked fish are present in spokedace habitat. The small numbers of stocked sportfish that may access the Upper Verde River reach is not likely to lead to the establishment of these species in the area; and as these species were present at the time of critical habitat designation and have not established populations in the upper Verde River, the likelihood that they will do so in the future is low. The effect of the small numbers of individuals that may be displaced into the upper Verde River from the Granite Creek stocking sites does not alter the existing predator and competitor community currently present.

Bluegill, black crappie, and largemouth bass are established in portions of the Verde River within the proposed critical habitat reaches but not in the upper Verde River. The potential for escapement from the Granite Creek stocking sites is limited to periods when the reservoirs spill. Such winter events possibly occurred three times between 1965 and 1984 and definitely in January and February 2005, January 2008, and January 2010.

To date, no black crappie has been documented in the upper Verde River and bluegills were documented only once in 1992. Largemouth bass have been found at total of eight times between 1966 and 2005 with 19 individuals recorded; however, they have not successfully reproduced and do not have an established population in the Upper Verde River. All species proposed for stocking (except rainbow trout) are already in one or more of the Granite Creek reservoirs (black crappie was known historically from all three but is only currently documented from Watson Lake), and stocking under the proposed action does not increase the potential for

these species to reach the Upper Verde River and the proposed critical habitat and does not support any self-sustaining populations of these species in the river. Rainbow trout is established in Oak Creek, but not generally in the other proposed sites and is only found seasonally while it is stocked so its effect is limited to the winter and spring, not the peak spawning season for spokedace. Also, stocking of rainbow trout into the Verde River and its tributaries is a continuing action, and is part of the baseline situation for nonnative species in the proposed units. As noted in the proposed rule, PBF 5 is already compromised in the Verde River and its tributaries due to the continuing presence of mosquitofish, red shiners, fathead minnows, green sunfish, smallmouth bass, yellow bullhead, and common carp (non of which are proposed for stocking).

The seven site survey information that documented the decline of the spokedace in the upper Verde River also contains information on the numbers of individuals of stocked species found. Since these surveys take place in summer, it would not be expected that rainbow trout would be detected. Bluegills (3) were found in 1992 but not since, and black crappies have not been found during those, or any other surveys in the upper Verde River. Largemouth bass have been found at total of eight times between 1966 and 2005 with 19 individuals recorded (Table 209). All but the 2004 and 2005 records are below the Verde-Granite Creek confluence; however, the remaining two are from Stillman Lake which may be connected to Granite Creek at high flows. Largemouth bass are not proposed for stocking into Watson or Willow Creek lakes (only Goldwater, which is 8.5 miles upstream of Watson Lake); however the species maintains populations in both lakes. The opportunity for largemouth bass in Goldwater Lake to reach Watson Lake exists due to connectivity, but since largemouth bass are already in Watson Lake, any largemouth bass in the upper Verde River is more likely from that source than from Goldwater Lake. It is unknown how long a bluegill, black crappie, or largemouth bass could persist in the upper Verde River once access was gained. Preferred habitats for these species may be limited, but is not unavailable and other habitats can support individuals for perhaps extended periods. During the time these individuals were present, there is opportunity for increased predation and/or competition with spokedace.

Table 20: All located largemouth bass records for Upper Verde River

| Date       | Location                                    | Number                     | Source                                                           |
|------------|---------------------------------------------|----------------------------|------------------------------------------------------------------|
| 1966       | T18NR1E (near Bear Canyon)                  | 1                          | SONFISH                                                          |
| 12/11/1989 | T17NR2W sec 12 (confluence Granite Creek)   | 1                          | SONFISH, likely record from Hendrickson 1993 survey data         |
| 7/18/1990  | T17NR2W sec 12 and 14 (below Granite Creek) | 5                          | SONFISH, likely record from Hendrickson 1993 survey data         |
| 2/5-6/1991 | T17NR2W section 15 (Sullivan Lake?)         | 2 (also 3 channel catfish) | SONFISH, likely record from Creef, Clarkson, and McGuinn-Roberts |

|                 |                              |                            |                         |
|-----------------|------------------------------|----------------------------|-------------------------|
|                 |                              |                            | 1992                    |
| 9/25-10/29/1992 | Morgan Ranch to Perkinsville | 6 (also 4 channel catfish) | Creef and Clarkson 1993 |
| 2000            | Near Sycamore Creek          | 1                          | Rinne compiled data     |
| 2004            | Stillman Lake                | 1                          | Cited USFWS 2009        |
| 2005            | Stillman Lke                 | 2                          | Cited USFWS 2009        |

PBF 7 and 5 are related to the presence of nonnative fish species and is already compromised in the upper Verde River due to the continuing presence of mosquitofish, red shiners, fathead minnows, green sunfish, smallmouth bass, yellow bullhead, and common carp. These species are, to varying degrees, competitors and/or predators on spikédace and most have been implicated in the declines of native minnow populations across the southwest. Special management for this critical habitat unit to eliminate nonnative fish species was identified at the time of designation.

The continuing presence of established populations of these warmwater nonnative species may have significant effects to the recovery potential of these critical habitat units that will be evaluated prior to final designation of critical habitat. Because we expect that there would be very few instances of stocked warmwater sportfish leaving the Watson or Willow lakes, and that those species, while already present in at least one of the two lakes, have not been regularly found or have established a self-sustaining population in the upper Verde River critical habitat unit, we believe that the additive effect of stocked warmwater sportfish accessing the upper Verde River would not significantly increase the numbers or species of nonnative fish present in the system over the period covered by this consultation or and increase predation and/or competition pressures such that the value of the critical habitat for recovery is further compromised.

Spikédace stocked into Fossil Creek that move downstream of the fish barrier into lower Fossil Creek or the Verde River are at risk of predation from the established fish populations present, and the additive rainbow trout from stocking actions has a minor temporary effect due to the limited number of rainbow trout that may access this portion of the Verde River and the limited time the rainbow trout are present.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Granite Creek stocking sites are on private lands and activities on the lakes, including scheduling water releases for flood control or other purposes are subject to non-Federal management. A portion of the watershed for the upper Verde River is on private and state lands where management actions are directed by non-Federal parties. The most proximal portion of the watershed is on the Coconino National Forest, where land management actions are subject to section 7 consultation.

The use of live baitfish is prohibited at waters in Yavapai County, including the Granite Creek stocking sites, so there is little impetus for anglers to introduce these species to the upper Verde River to create sources for use in the Granite Creek stocking sites. Waterdogs are legal and may be used for largemouth bass at Goldwater Lake. Live baitfish and waterdogs are legal for use in the Verde River below Tuzigoot Bridge downstream to the confluence with the Salt River. Baitfish must be captured locally since movement of live bait above Horseshoe Reservoir is not permitted. Live baitfish are not used for fishing for stocked rainbow trout, so there is no impetus to catch or move bait species within the Verde resulting from the proposed action. Of the nonnative species that maintain populations in the upper Verde River, only red shiner (a species used for bait below Tuzigoot Bridge) were stocked into one of the reservoirs (Watson); fathead minnow, and green sunfish are other bait species that were likely illegally introduced to the upper Verde River in the past and now maintain populations in the river. Some of the records for largemouth bass, particularly those at Stillman Lake, may also be the result of either illegal stockings or transport into the area from other self-sustaining populations in the watershed. The Area-Wide analysis will look at the effects of illegal or inadvertent transport of unwanted aquatic organisms on the larger scale.

### *San Francisco River*

#### **Description of the action area**

The San Francisco River action area includes Luna Lake and extends down the San Francisco River to the spikedace reintroduction site near Glendale, New Mexico. Suitable habitat for salmonids is only seasonally available in the San Francisco River at the reintroduction site; however, stocked fish leaving Luna Lake during spring flood flows can reach the reintroduction site even if they do not persist over the summer. Proposed critical habitat for the spikedace is found in this action area.

#### **A. Status of the species and critical habitat within the action area**

Spikedace were stocked into the San Francisco River at the US 180 bridge near Glenwood in 2008 (112 individuals), and the population was augmented with an additional 350 individuals in 2009. Additional augmentations to the population are anticipated over the next several years (USFWS 2009g). As of yet, the spikedace have not established a population at this site.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

The San Francisco River has suffered from erosion and extensive water diversion and at present has an undependable water supply throughout much of its length. In the vicinity of Glenwood there are agricultural areas and small towns. The area where spikedace were reintroduced has low numbers of nonnative fishes, with mosquitofish and fathead minnows the most abundant and occasional largemouth bass or rainbow trout detected from 1988-2005 (Paroz et al. 2006). The native fish community here is relatively intact, which was the principal reason for selecting this site for spikedace restoration.



The San Francisco proposed critical habitat unit supports PBFs 1-4 and 6. Because of nonnative fish populations, PBF 5 may be compromised. Essential features may require special management of or protection from land management practices including improper livestock grazing, water diversions, road construction, channelization, and the presence of nonnative species.

## EFFECTS OF THE ACTION

The spokedace reintroduction site is nearly 50 miles downstream of Luna Lake. Impacts to spokedace from stocking rainbow and/or cutthroat trout into Luna Lake are related to trout potentially escaping Luna Lake during times of the lake spilling (snow melt, monsoonal discharges, or from irrigation water releases through the headgate in the dam during summer months) and potentially moving downstream in the San Francisco River to occupied spokedace habitats in the San Francisco River. Predation on spokedace by rainbow trout or cutthroat trout escaping the lake is the potential effect. Stocking of fingerlings, sub-catchables, and catchables at the lake assumes that at smaller trout will adapt to a natural diet and grow to catchable size. Those fish are more likely to be predators on spokedace than those released as catchables. Trout are present in the lake all year and could be released at any time the lake spills.

Rainbow trout fishing is reportedly good between Luna, New Mexico and the Arizona stateline, as well as at the Frisco Box a few miles downstream of that. Cutthroat trout have not been documented in any surveys in the action area outside of Luna Lake. No trout are legally stocked in the San Francisco River in New Mexico, so the origin of these trout is unknown and some may originate in Arizona from Luna Lake. Wild rainbow trout are also found in the Tularosa River, and rainbows and rainbow-Gila hybrids are reported from South Fork of Negrito Creek and the mouth of North Fork of Negrito Creek, which in some years have some of the best trout fishing on the Gila National Forest (Johnson and Smorynski 1998). Rainbow trout in these systems are not supported by current stocking actions in New Mexico, and are most likely wild fish with self-sustaining populations. Based on the physical information about the reach of the San Francisco River from Luna Lake to occupied spokedace habitat, including the distances involved, we expect limited numbers of rainbow trout from Luna Lake to access occupied spokedace habitats in the reintroduction site from Luna Lake supporting or augmenting the wild trout populations in spokedace habitat is doubtful. However, as a conservation measure, AGFD will share information with the New Mexico Department of Game and Fish (NMDGF) on salmonid populations in occupied habitats.

There are wild trout populations in portions of the designated and proposed critical habitat reaches in the upper San Francisco River drainage. The role of past stocking of rainbow trout into Luna Lake contributing to the establishment or maintenance of these wild trout populations is uncertain. However, the opportunity for rainbow trout from Luna Lake to contribute to the maintenance of these trout populations will be essentially eliminated due to the use of triploid rainbow trout for stocking at Luna Lake. That conversion will occur over a three-year schedule at the beginning of the 10-year period covered by this consultation. Any rainbow trout that did access the critical habitat might persist if conditions were appropriate; but the likely numbers of such fish added to the existing rainbow trout populations is not expected to significantly increase those wild populations and have an adverse effect on PBF 5. If rainbow trout from Luna Lake

are supporting the recruitment to the wild populations, then the proposed action could result in a net benefit by eliminating that support.

While escaped trout may not persist over a year, while they are present they affect PBF 5, and, while they are present they use space and some of the available food base provided by the critical habitat (affecting PBF 2) that may reduce the amount of resources available to the spikedace.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Luna Lake is on the Apache National Forest. Recreational facilities and the concession are managed or licensed by the Forest Service. Watershed activities are also managed by the Forest Service. Water releases from the lake are managed by the Luna Irrigation Company (which owns most of the water rights outside of a minimum pool right owned by AGFD). Below the lake along the San Francisco River, most of the land is on the Apache and Gila National Forests, with private inholdings concentrated at the towns of Luna, Reserve, Alma and Glenwood. Watershed management is primarily by the Forest Service, with local water use and development activities on private lands subject to limited Federal involvement.

Use of live baitfish at Luna Lake is prohibited, however, waterdogs are allowed. Fathead minnow and waterdogs are found in the lake, the initial sources of these species are unknown; however, fathead minnows are also found in the river below the lake as far downstream as Glenwood (Propst et al. 2009). There is no impetus to establish live bait populations for use in Luna Lake to pursue stocked trout.

### *Tonto Creek*

#### **Description of the action area**

The action area extends on Tonto Creek from the stocking reaches in the headwaters of the Tonto Creek drainage downstream to Greenback including the tributaries proposed as critical habitat.

#### **A. Status of the species and critical habitat within the action area**

Spikedace are no longer found in the Tonto Creek drainage.

#### **B. Factors affecting the species' environment and critical habitat within the action area**

All five proposed reaches of critical habitat support PBFs 1-4. The ability of any of the proposed reaches to support new PBF 5 at this time is unknown. All the reaches maintain significant populations of nonnative species. The ability of these streams to support PBF 6 was not mentioned in the proposed rule. Essential features may require special management of or

protection from land management practices including improper livestock grazing, water diversions, road construction, channelization, and the presence of nonnative species.

## EFFECTS OF THE ACTION

Introduction of rainbow trout into three headwater stocking sites on Tonto Creek may affect PBF 5. However, conditions suitable for the establishment of rainbow trout are not present in the proposed critical habitat reach. While there may be a few rainbow trout displaced from the headwaters to the critical habitat and those could persist until high water temperatures occur in the spring and summer. This could have a minor effect on PBF 2; however, the number of trout likely to reach the critical habitat area in any given year is very low and unlikely to persist long enough to impact the forage base and impact the recovery value of the critical habitat unit. Until spokedace are reintroduced to this critical habitat unit, there are no effects directly to spokedace in the form of predation. With the limited opportunity for rainbow trout to reach the critical habitat unit, and the limited time period they could be present, we do not believe that the level of potential predation would be sufficient to have a significant adverse effect on the spokedace population (should one be established) that would compromise the recovery value of this unit.

Furthermore, the transition to the stocking of triploid rainbow trout will eliminate the potential to augment existing reproducing rainbow trout populations in the upper watershed that can also move downstream during flood events. If future restoration efforts restore PBF 5 to Tonto Creek by removing nonnative species, the continued stocking of triploid rainbow trout in the headwaters is not likely to contribute numbers of rainbow trout in the critical habitat unit sufficient to reach a level precluding the persistence of spokedace in the critical habitat reach, since there would be even fewer rainbow trout to move out of the headwaters, and since they are not wild trout, may not have converted to natural foods.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to spokedace populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986),

probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect spokedace. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CONCLUSION

After reviewing the current status of spokedace in the Verde and San Francisco rivers and its designated and proposed critical habitat in the Verde River, San Francisco River, and Tonto Creek, the environmental baseline for the action area, the effects of the proposed stocking of sportfish into stocking sites on the Verde River, Luna Lake and Tonto Creek and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the spokedace, and is not likely to destroy or adversely modify designated critical habitat in the Verde River or additional proposed critical habitat in the Verde, Tonto, and San Francisco drainages.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.”<sup>8</sup>

We present this conclusion on the spokedace and its critical habitat for the following reasons:

- For the upper Verde River, the low number of documented individuals of stocked sportfish species in spokedace habitat combined with the low numbers of spokedace present, likely results in limited opportunities for competition and predation. Furthermore, because the stocked species are already present in the Granite Creek drainage and survey information over 20 years has not documented many individuals of bluegill (3) or largemouth bass (19) and no black crappie, we do not believe it is likely that these species will, based on the limited opportunity for them to access the upper Verde River from Granite Creek, establish populations in the period of time covered by this consultation. While there may be some predation and competition between spokedace and any escaped sportfish, the magnitude or frequency of such events is unlikely to have a meaningful effect on the size or distribution of the spokedace population in the upper Verde River.
- The ability of the spokedace population in the San Francisco River to establish a self-

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<sup>8</sup> see December 27, 2004, memo from Acting Director Fish and Wildlife Service

sustaining population is not likely to be significantly impacted by the proposed actions at Luna Lake. It is unlikely that any rainbow trout from Luna Lake would reach proposed critical habitat; however, any that did could affect PBF 5, and, while they are present they use space and some of the available food base provided by the critical habitat (affecting PBF 2) that may reduce the amount of resources available to the spokedace. The transition to triploid rainbow trout will essentially eliminate any support from stocking in Luna Lake to maintain wild trout populations within the critical habitat. The conservation value of critical habitat could be improved if such support is removed from the wild trout populations and they decline as a result.

- The status of PBF 7 and 5 in the designated critical habitat in the upper Verde River would not be significantly altered by the occasional presence of individuals of stocked sportfish species in the critical habitat that could result in competition between spokedace and the stocked sportfish for resources such as food and shelter. This infrequent circumstance does not preclude restoration of full functionality of the critical habitat to meet this PBF due to the infrequency of occurrence and lack of persistence of the stocked sportfish in the critical habitat. While escaped fish may not persist, while they are present they affect PBF 7 or 5, and, while they are present they use space and some of the available food base provided by the critical habitat (affecting PBF 2) that may reduce the amount of resources available to the spokedace. This effect is minor and does not alter the ability of the critical habitat to provide for survival and conservation of the spokedace.
- Minor effects to PBFs 7 and 5 in the Verde River below Tapco Diversion proposed critical habitat units may occur from the presence of stocked rainbow trout. The presence of these trout is additive to the existing nonnative fish community. However, rainbow trout do not persist in most of the units, and their additive effect to the ability of the proposed critical habitat to provide for survival and conservation of the spokedace is not significant.
- Effects to PBFs 7 and 5 in the Tonto Creek proposed critical habitat units are unlikely to occur due to the short time any rainbow trout would likely be present in the units.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant

habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take for the following sites and reasons:

- Upper Verde River: Spikedace are not present in the stocking sites, but are present in the upper Verde River below the sites. Stocked sportfish must move from the stocking sites into the upper Verde River for exposure to spikedace can occur. We believe this event is likely to occur, so the first condition is met. The number of stocked sportfish that access the upper Verde River is likely to be very low. The upper Verde River supports a robust nonnative predator population that is not supported by stocked sportfish, and that is more likely to encounter a spikedace in the river. We are not reasonably certain that the proposed action would result in take, thus the second condition is not met.

#### Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

#### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to

minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for spokedace contingent upon CAMP funding availability as described in the Program document. The ability to implement recovery actions for spokedace under the auspices of the CAMP provides conservation benefits to spokedace that may not be otherwise realized.
2. We recommend that AGFD participate in protection of the upper Verde River through barrier construction, with emphasis on developing an ecologically sound basis for barrier placement with an emphasis on the management of listed and other native species.
3. We recommend that AGFD participate in development of suitable renovation efforts in the upper Verde River.
4. As recognized in the BA, conservation and enhancement of the upper Verde River's native aquatic community is critically important to the future persistence and existence of native fish species. Development of a native fisheries management plan for the Upper Verde River Wildlife Area would enhance protection in this area.
5. Continue assisting in the propagation efforts for spokedace at Bubbling Ponds to facilitate the augmentation of the San Francisco spokedace population. Assist in the augmentation and/or monitoring efforts of spokedace in the San Francisco River.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### *Candidate species*

#### **Headwater chub (*Gila nigra*)**

#### DESCRIPTION OF THE PROPOSED ACTION

Headwater chub are potentially affected by stocking into the Tonto Creek Complex and Lower Verde Complex (Table 21). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 21: Stocking sites, sportfish species proposed for stocking, and potentially affected headwater chub populations

| <b>Stocking complex/site</b>     | <b>Species stocked</b> | <b>Headwater chub population</b>    |
|----------------------------------|------------------------|-------------------------------------|
| <i>Lower Verde River Complex</i> |                        |                                     |
| East Verde River                 | ONMY                   | East Verde River, Webber Creek      |
| Green Valley Lake                | ONMY                   | Pine Creek, The Gorge, Fossil Creek |
| <i>Tonto Creek Complex</i>       |                        |                                     |

|                   |      |                                             |
|-------------------|------|---------------------------------------------|
| Christopher Creek | ONMY | Tonto Creek                                 |
| Haigler Creek     | ONMY | Haigler Creek, Marsh Creek,<br>Gordon Creek |
| Tonto Creek       | ONMY | Tonto Creek                                 |

Conservation measures included in the proposed action

Headwater chub is a priority species for conservation in the proposed action and as such, will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

AGFD commits to provide for three populations of headwater chub either through securing existing but threatened populations or establishment of new conservation populations. The first population will be initiated within three years, the second population within six years, and the third population within eight years.

Within three years, the AGFG shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild or reintroduced populations of headwater chub

Headwater chub habitats in the East Verde River and Tonto Creek shall be considered priority areas for use of triploid rainbow trout to avoid augmentations to existing wild populations. This measure will be implemented within three years of the implementation of the proposed action.

AGFD shall implement actions to increase angler awareness of headwater chub, including the fact that headwater chub is not a legal sportfish at the East Verde River and Haigler Creek stocking sites. This measure will be implemented within three years of implementation of the proposed action.

In order to obtain information needed to implement conservation actions, AGFD shall undertake an assessment of headwater chub populations in the East Verde River, Tonto Creek, and the Haigler Creek drainage to determine population structure and extent, nonnative species present as stressors, sites for potential reestablishment, and identification of specific research needs. This assessment shall tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for headwater chub and five other native fish species, as that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment will serve as a guidance document for implementing conservation actions for the headwater chub. This assessment shall be completed within three years.

Within three years, AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.



## STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

*Listing*

Headwater chub became a candidate species in May, 2006 (71 FR 26007). The historical range of headwater chub is the Gila River basin in Arizona and New Mexico. The species is closely related to the Gila chub (*Gila intermedia*) and roundtail chub (*G. robusta*) and has only recently been identified as a separate taxon (Minckley and DeMarais 2000). The historical distribution of headwater chub in Arizona remains poorly understood due in part to the taxonomic confusion with other *Gila*, the lack of early collections, and widespread manmade changes to habitats within the basin that likely affected distribution.

*Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the headwater chub. This information was taken from Voeltz (2002), the 12-month finding (USFWS 2006a), the 2009 petition for emergency listing (Stefferdud et al. 2009), and the most recent candidate assessment form (USFWS 2010b). Information in these documents is incorporated by reference.

*Life history*

Spawning in Fossil Creek (which contains both roundtail and headwater chub) occurred in spring and was observed in March in pool-riffle areas with sandy-rocky substrates (Neve 1976). Neve (1976) reported that the diet of headwater chub included aquatic insects, ostracods, and plant material.

*Habitat use*

Headwater chubs occur in the middle to upper reaches of moderately-sized streams (Minckley and DeMarais 2000). Bestgen and Propst (1989) examined status and life history of chubs in the Gila River drainage in New Mexico and found that habitats containing both Gila and headwater chubs consisted of tributary and mainstem habitats in the Gila River at elevations of 1,325 m (4,347 ft) to 2,000 m (6,562 ft). Maximum water temperatures for habitats of the Gila, headwater and roundtail chub vary from 20° to 27°C (68° to 81°F), with minimum water temperatures of 7° C (45°F) (Bestgen and Propst 1989, Barrett and Maughan 1995). Typical adult habitats containing both Gila and headwater chub consisted of nearshore pools adjacent to swifter riffles and runs over sand and gravel substrate, with young of the year and juveniles using smaller pools and areas with undercut banks and low velocity (Bestgen and Propst 1989).

*Current distribution*

The species occupies the East, Middle, and West forks of the Gila River (Carman 2006, Stefferud et al. 2009), and may occupy lower Turkey Creek below a barrier and the Gila River below the forks area in New Mexico, although these fish have not been definitively identified

(Stefferd et al. 2009). In Arizona, headwater chub occupy: tributaries of the Verde River including Fossil Creek, East Verde River (including tributaries The Gorge, Pine Creek, and Webber Creek), Wet Bottom Creek, and Deadman Creek; and Tonto Creek and several of its tributaries (Buzzard Roost, Dinner, Gordon, Gunn, Haigler, Horton, Marsh, Rock, Spring, Turkey creeks) (Voeltz 2002, Stefferud et al. 2009). Headwater chub may still occur in parts of the San Carlos River basin, although recent survey information for these streams is unavailable because San Carlos Tribal survey information is proprietary and confidential (Voeltz 2002, Stefferud et al. 2009). The taxonomic status of chub in upper West Clear Creek has still not been resolved; however, the most recent findings do not place them clearly with either species (Dowling 2010). Genetic and morphometric confirmation as headwater chub is also lacking for The Gorge and Pine Creek sites on the East Verde River, and for Wet Bottom Creek on the Verde River. Recently completed genetic research includes recommendations for management units for headwater chub, as well the related Gila and roundtail chubs (Schwemm 2006, Dowling et al. 2008).

In the documents cited above, headwater chub populations are rated based on population stability and security, the latter relating to the degree of threat that a population is exposed to. We will use this status information, so provide the definitions in Table 22.

Table 22: Definitions of status description categories used to describe the status of headwater chub populations (from Voeltz 2002).

| <b>Status</b>            | <b>Definition</b>                                                                                                                                                                                                                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stable-Secure (SS)       | Chubs are abundant or common, data over the past 5-10 years shows a stable, reproducing population with successful recruitment; no impacts from nonnative aquatic species exist; and no current or future habitat altering land or water uses were identified.                                            |
| Stable-Threatened (ST)   | Chubs are abundant or common, data over the past 5-10 years shows a reproducing population, although recruitment may be limited; predatory or competitive threats from nonnative aquatic species exist; and/or some current or future habitat altering land or water uses were identified.                |
| Unstable-Threatened (UT) | Chubs are uncommon or rare with a limited distribution; data over the past 5-10 years shows a declining population with limited recruitment; predatory or competitive threats from nonnative aquatic species exist; and/or serious current or future habitat altering land or water uses were identified. |
| Extirpated (E)           | Chubs are no longer believed to occur in the system.                                                                                                                                                                                                                                                      |
| Unknown (U)              | Lack of data precludes determination of status.                                                                                                                                                                                                                                                           |

The 2009 petition provided a new assessment of the number of populations that are currently extant (Stefferd et al. 2009). Their rationale is that some streams are connected, and genetic analysis indicates that these connected reaches, or in some cases reaches that are not necessarily connected but are close together geographically, should be considered a single population. Although this approach is logical in terms of management units, we do not have definitive

information to indicate that these stream complexes are in fact currently functioning as separate populations from a population-genetics standpoint. For this reason, and to maintain consistency with past assessments of Gila River chub status (Weedman et al. 1996, Voeltz 2002, USFWS 2005a, 2006a, 2009a) we continue to assess status here by individual stream occupancy. It should be noted that we have removed West Clear Creek as a headwater chub population because current data indicates it is roundtail chub and it was included in the positive 12-month finding for that species in 2009 (USFWS 2009a). We provide our 2010 assessment of headwater chub-occupied streams in Table 23. The discovery of smallmouth bass above the barrier in Fossil Creek in July, 2011 (Crowder 2011) may warrant a change to the “stable-secure” status of that stream if the smallmouth bass cannot be eliminated before they establish a population. Surveys during June, 2011, documented headwater chub in the East Verde River from Ellison Creek to below Highway 87 (C. Cantrell, AGFD, pers. comm.) and this data will be used to refine the status of that stream in the future.

Table 23: Summary of headwater chub status and threats by stream reach (Voeltz 2002, Schwemm 2006, AGFD 2008, USFWS 2010b).

| Stream Reach                                    | Status | Primary Threats                                                                                                                                                                                                                                                                 |
|-------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| East Fork Gila River                            | UT     | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest, wildfire.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                                                                              |
| Middle Fork Gila River                          | UT     | Factor A: Improper livestock grazing, limited fuelwood harvest, wildfire.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                                                                                          |
| West Fork Gila River                            | UT     | Factor A: Improper livestock grazing, limited fuelwood harvest, wildfire.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                                                                                          |
| Turkey Creek (NM)<br>And Gila River below forks | U      | Factor A: Improper livestock grazing, limited fuelwood harvest, wildfire.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                                                                                          |
| San Carlos River                                | U      | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |
| Ash Creek                                       | U      | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |
| Tonto Creek                                     | UT     | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, improper livestock grazing, roads.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                          |
| Christopher Creek                               | E      | Factor A: Water diversions, groundwater pumping, dewatering, urban and agricultural development, improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.                                                                              |

|                   |    |                                                                                                                                                                                                                 |
|-------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   |    | Factor E: Climate change.                                                                                                                                                                                       |
| Gun Creek         | UT | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Horton Creek      | E  | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Rye Creek         | E  | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Sharp Creek       | E  | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Haigler Creek     | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Gordon Creek      | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Marsh Creek       | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Spring Creek      | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Buzzard Creek     | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Rock Creek        | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Dinner Creek      | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Turkey Creek (AZ) | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change.                                                                        |
| Fossil Creek      | SS | Factor A: Recreation.                                                                                                                                                                                           |
| East Verde River  | UT | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, improper livestock grazing.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |
| Webber Creek      | UT | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, improper livestock grazing.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |

|                  |    |                                                                                                                                          |
|------------------|----|------------------------------------------------------------------------------------------------------------------------------------------|
| The Gorge        | U  | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |
| Pine Creek       | U  | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |
| Deadman Creek    | ST | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |
| Wet Bottom Creek | UT | Factor A: Improper livestock grazing, recreation, limited fuelwood harvest.<br>Factor C: Nonnative species.<br>Factor E: Climate change. |

### Threats

Threats to headwater chub are identified briefly in Table 23. Loss of habitat due to water withdrawals and other modifications to streamflow, channelization, improper livestock grazing, mining, roads, logging, and development activities has been significant and continues to occur. Climate change may also have an effect on the availability of habitat in the future if droughts continue.

Catastrophic wildfire is also a risk to species like the headwater chub that are in isolated headwater areas of small streams, as a fire or its aftermath can eliminate the entire population area. This is of particular concern for the headwater chub since the primary occupied drainages in Arizona (Fossil Creek, East Verde River, and Tonto Creek) are within close proximity to each other and a large wildfire could affect multiple occupied waters. Extreme summer fires, such as the 1990 Dude Fire, and corresponding ash flows have decimated some fish populations including headwater chub populations in the East Verde River (Voeltz 2002). Recently, several extreme summer fires, including the 2002 Rodeo-Chediski Fire and the 2004 Willow Fire, may have resulted in losses of individuals and populations of headwater chub throughout Arizona. Carter and Rinne (unpubl. data) found that the Picture Fire both benefited and eliminated headwater chub from portions of Spring Creek. The fire eliminated chubs from Turkey Creek, a tributary to Spring Creek. In other parts of Spring Creek, however, headwater chubs initially declined, but later thrived after the fire, presumably because most of the nonnative fishes were eliminated. Additionally, several populations in the Mazatzal Mountains in central Arizona may have been eliminated in 2004 due to the Willow Fire (A. Robinson, AGFD, pers. comm.). Recent fires on the Upper Gila River in New Mexico and in the upper East Verde River watershed have had effects to those headwater chub populations. Therefore, every extant population of headwater chub is at risk of experiencing effects from wildfire.

Recreational activities can also affect habitat through trampling of streambanks that removes vegetation cover and increases erosion. With the exception of the limited catch-and-release fishery in Fossil Creek, headwater chub are not a legal game species in Arizona or New Mexico and must be released unharmed if caught. There is an amount of by-catch that occurs in occupied headwater chub streams that are also open to angling (East Verde River and Haigler Creek). Anglers pursuing stocked rainbow trout in the upper East Verde River commonly

capture headwater chub (C. Cantrell, AGFD. pers comm.). While a single capture by anglers may not result in death of the individual chub, the type of tackle used and the experience of the angler in safely releasing the fish are factors in post-release survival. To date, no studies have evaluated headwater chub mortality rates caused by angler catch. While many anglers may release captured headwater chub safely, D. Propst of NMDFG (cited in Voeltz 2002), believed that some anglers may not safely release headwater chub due to a misconception that they do not belong in the stream and discard them as unwanted.

Headwater chub evolved in a fish community with low species diversity and where few predators existed, and as a result developed few or no mechanisms to deal with predation (Clarkson et al. 2005). In its habitats, the headwater chub was probably the most predatory fish and experienced little or no competition except potentially from native trout species if they co-occurred.

Direct predation by nonnative aquatic species on and competition of nonnative aquatic species with, the headwater chub are major factors in the rangewide population declines and local extirpations (Christopher Creek, Rye Creek, and Horton Creek). Nonnative aquatic organisms can negatively affect native fish through predation, aggression and harassment, resource competition, habitat alteration, aquatic community disruption, introduction of diseases and parasites, and hybridization (USFWS 2002a, 2008a). Based on survey information, nonnative species occur in every known population of headwater chub (Voeltz 2002). Even in Fossil Creek, which after renovation had no nonnative fish species, crayfish are still abundant. The continuing presence of nonnative aquatic species that prey on and/or compete with headwater chub are a serious and persistent threat to the continued existence of this species.

Headwater chub, like their close relative, the roundtail chub, are considered to be very “trout-like” in their use of habitats, with adults using pools adjacent to riffles and runs over sand and gravel substrates preferred habitats and young of the year and juveniles using smaller pools and areas with undercut banks and low velocities (Bestgen and Propst 1989). This habitat preference overlaps with that for rainbow trout. Both rainbow trout and headwater chub forage for similar prey, particularly aquatic invertebrates, and both feed on drift at the surface. Further, adult headwater chub seldom reach over 30 centimeters (12 inches), so they are smaller or equal in size to the catchable sized rainbow trout proposed for stocking. As discussed previously, headwater chub evolved in an environment with few competitors, and their ability to compete with nonnative fish species may be limited. We do not know to what exact degree rainbow trout competition and predation can impact populations of headwater chub because although rainbow trout are generally considered to be less piscivorous, they do consume small fish and can directly compete with headwater chub. Therefore, they are a species of concern for the headwater chub.

Overall, survey data shows that headwater chub populations in New Mexico are declining. There is insufficient survey data to quantitatively assess the trends for populations in Arizona, except for Fossil Creek. The headwater chub population there is still in flux (Stefferdud et al. 2009). The populations in the Tonto Creek drainage are in two small clusters (Haigler Creek drainage and Spring Creek drainage) that are vulnerable to catastrophic wildfire, as is the Fossil Creek population. Many other populations such as Deadman Creek and Wet Bottom Creek are also very small and isolated with similar threats. Taxonomy issues continue to exist, particularly for recently located sites, and this complicates understanding the relationships between sites in

the same drainage.

#### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of conservation actions for the headwater chub.

Survey and recovery work for the headwater chub is guided by the Recovery Plan in New Mexico (Carman 2006) and includes monitoring of the extant populations. In Arizona, headwater chub is covered by the Six Species Conservation Program (AGFD 2006). This program has provided administrative oversight on the species and is making progress on numerous projects planned for implementation over the next ten years. The conservation efforts of this program, led by the AGFD, have led to the completion of a considerable amount of genetic research as well as the documentation of two new occupied waters. The Fossil Creek restoration funded by the Gila River Basin Native Fishes Conservation Program provided significant benefits for headwater chub; and further benefits could be realized from this program if the Spring Creek restoration project moves forward. This project may not be implemented for several years.

#### *Previous consultations*

The headwater chub is not a listed species and has not been considered in section 7 consultations.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

The action area for the proposed stocking actions encompasses two disjunct drainages that are in close proximity to but isolated from each other: Tonto Creek and East Verde River. The drainages are assessed separately.

#### *East Verde River*

#### **Description of the action area**

The action area for the East Verde River is the mainstem and connected tributaries from the headwaters to the confluence with the Verde River. The portion of the mainstem Verde River from its confluence with Fossil Creek downstream to the confluence with the East Verde River is also included to assess escapement issues of stocked sportfish leaving the stocking sites.

#### **A. Status of the species within the action area**

Survey information for headwater chub in the East Verde River is limited. The known population in the upper reaches (lower Webber Creek and the mainstem north of Payson) was last surveyed in 2000 (Voeltz 2002) and were in low numbers. However, recent anecdotal information from anglers within the stocking reach (from Highway 260 upstream) report catching numerous headwater chubs in multiple age classes (C. Cantrell, AGFD, pers. comm. 2010) and surveys in 2011 also reported headwater chub from below Ellison Creek to the highway crossing (C. Cantrell, AGFD, pers. comm. 2011). There are other connected waters in this area, particularly Ellison Creek, may provide habitat for headwater chub. In addition to the Webber Creek and mainstem occupied sites, headwater chub are known from Pine Creek and The Gorge, small streams that are tributary to the East Verde River downstream of the two stocking sites near the confluence with the Verde River. In our 2010 candidate assessment (USFWS 2010b), all four occupied headwater chub waters in the East Verde River drainage were ranked as “unstable-threatened” or “unknown” based on the available data. The more recent information on headwater chub abundance in the mainstem East Verde River in several locations including near Ellison Creek, may warrant a revision of the status of that water to “stable-threatened,” once the data is reviewed. In summary, there is limited survey data for the East Verde River drainage and little is known about the population dynamics or trends for headwater chub in this action area.

## **B. Factors affecting the species’ environment within the action area**

Past wildfires, including the catastrophic Dude Fire in 1990 and more recent fires (2008) have significantly altered the watershed conditions that influence how precipitation or snowmelt runs off and the amount of sediment that is carried by that runoff. Post-fire runoff also carries ash, which when mixed in water becomes toxic to aquatic life and causes fish kills. Dude Creek itself was rendered fishless by these flows, which entered the East Verde River above the occupied habitat area for headwater chub. Fish kills were reported in the East Verde River after this fire. The 2009 Waterwheel Fire burned along the west side of the river between Diamond Creek and Webber Creek and may have resulted in some toxic materials reaching the occupied habitat within the stocking reach.

The East Verde River supports a mixed population of native and nonnative fish, with the species composition varying across its length. In the stocking reach, native species recorded include longfin dace, desert sucker, Sonora sucker, speckled dace, and headwater chub. Nonnative species present include yellow bullhead, goldfish, red shiner, green sunfish, smallmouth bass, and rainbow trout. Wild populations of rainbow trout are present in the headwaters above Milk Creek, in Webber Creek, Ellison Creek, and in the mainstem. The lower reaches of the East Verde River support a mix of the natives mentioned above and the same nonnative assemblage (with the exception of rainbow trout, which are not present below the Highway 260 crossing during the summer months due to high temperatures). Crayfish are also present in the river. The presence of nonnative predators has effects on the headwater chub populations through predation and competition.

The upper East Verde River is perennial, with seasonal peaks relating to snowmelt and precipitation events. Additional flows come from water diverted into the East Verde River from



CC Cragin Reservoir on Clear Creek on the other side of the Mogollon Rim. In the past, this water has supported summer flows in this reach. These flows will be restarted at approximately 30 cfs from April through late September, depending on the amount of water in CC Cragin, and storage available downstream in the Verde River. The City of Payson will take up to 10 cfs directly from the existing diversion inflow in a new pipeline to support municipal and commercial uses in Payson, and the diversion point is upstream of the occupied headwater chub habitat, thus the reduction in flows may have an effect on the amount of habitat available during the already low-flow summer months.

The current status of the headwater chub in the East Verde River is a result of past land and water management practices, droughts, wildfire events, introduction of nonnative aquatic species, and recreational activities including angling.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the headwater chub are in Voeltz (2002), the 12-month finding (USFWS 2006a), the candidate assessment (USFWS 2010b). All these documents are incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on headwater chub.

The status of the headwater chub population in the upper East Verde River and Webber Creek is rated as unstable-threatened. We have recent anecdotal evidence of the current status of the population from anglers that accidentally catch them while fishing for trout and June, 2011, survey data documented the anecdotal evidence by finding headwater chub over the entire survey area, which is entirely within the stocking reach.

Rainbow trout can be competitors with headwater chub for food and space, and may be predators on small headwater chub. The stocking action would put up to 32,000 catchable and subcatchable rainbow trout per year into occupied headwater chub habitat in multiple stockings from April through August. Stockings are completed weekly to maintain catch levels in the high intensity fishery. This schedule allows rainbow trout to be present in the headwater chub habitat throughout the reproductive period for the headwater chub (headwater chub in Fossil Creek, a lower elevation than the East Verde River, begin to spawn in March). The number of rainbow trout stocked each week may not be sufficient to overload the capacity of the habitat to provide at least shelter for headwater chub, but the continuing level of competition may adversely affect the ability of the individual chub to properly forage and rest, resulting in degraded health

conditions. Fish in poor health have lower growth rates, may have lower fecundity in the following year, and may not survive overwinter as well as healthy fish. The upcoming reductions in summer inflows from CC Cragin Reservoir that reach the occupied portion of the East Verde River may also exacerbate crowding in the co-occupied reach (which is essentially the portion between Ellison Creek and Highway 87).

Angler bycatch of headwater chub in the East Verde River is documented by anecdotal information from the flyfishing community. Headwater chub are not a legal sportfish in the East Verde River, and must be released alive immediately upon capture. There may be a difference in the behavior of flyfishers and other anglers to catching a nontarget species that may be reflected in how carefully headwater chub are released. There are no definite figures on hooking mortality for headwater chub; however, a loss of up to 10 percent may be a reasonable assessment (Stefferd et al. 2009).

Stocking of rainbow trout into Green Valley Reservoir is unlikely to affect the headwater chubs in Pine Creek and The Gorge. Rainbow trout would be stocked in the winter but are not likely to persist over the summer due to high water temperatures. Most spills from the lake are in the winter and early spring while rainbow trout are being stocked. Any rainbow trout that left the lake could reach the East Verde River where it joins the occupied headwater chub habitats at Pine Creek or The Gorge. Headwater chub from those streams may also move into the river during higher flow periods so there is a potential for exposure. Rainbow trout might live a brief time in the lower East Verde River, but they would not persist and are not a concern for headwater chub in the lower East Verde River.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The stocking sites are all on Tonto National Forest lands; however, there are some private lands used for residential purposes along the river in the occupied habitat area. Since most of the land within the action area is managed by the Forest Service; most activities that could potentially affect these species are Federal activities and subject to additional section 7 consultation. We are not aware of any additional development on the private lands along the river that could result in changes to conditions for headwater chub.

New development in the vicinity of Payson may result from the additional water supplies from Clear Creek. The effect of more residents and facilities for visitors in the area may increase the amount of angling pressure, which may affect headwater chub. We have already noted the potential effects on the headwater chub population from anglers, some of which may be pursuing wild trout and not stocked trout.

Use of live bait fish is illegal in the East Verde River stocking areas and downstream to Roosevelt Lake. Use of nonnative tiger salamanders as bait is legal; however, tiger salamanders

are not used as bait for stocked trout so there is little incentive to bring them into the stocking reach.

### *Tonto Creek*

#### **Description of the Action Area**

The Tonto Creek action area extends from the stocking reaches of Christopher and Tonto creeks down to Bear Flat Campground and from there down Tonto Creek to Punkin Center. It also includes the Haigler Creek drainage including Gordon, Marsh, and Spring creeks up to the private lands above Alderwood Campground including the stocking reach down to its confluence with Tonto Creek near Hells Gate, the Spring Creek drainage, located midway between Hells Gate and Gisela from its confluence with Tonto Creek up to its headwaters, and Gunn Creek.

#### **A. Status of the species within the action area**

Headwater chub are found in Tonto Creek from the waterfall below Bear Flat Campground downstream to the vicinity of Hells Gate. They may be above this waterfall in low numbers, and additional surveys are needed. Headwater chub were historically found further downstream, as far as Punkin Center, but the surveys are sporadic and incomplete. Headwater chub are also in the Haigler Creek drainage in Gordon, Haigler and Marsh creeks. Based on the 2010 candidate assessment (USFWS 2010b), headwater chub in Tonto Creek are considered “unstable-threatened,” “stable-threatened” in the Haigler Creek drainage, “stable-threatened” in the Spring Creek drainage, and “unstable-threatened” in Gunn Creek. They are extirpated from Tonto Creek above Bear Flat Campground, Christopher Creek, Horton Creek, Rye Creek, and Sharp Creek. The “stable-threatened” rankings for Haigler and Spring creeks drainages was based on surveys in 2000 that documented significant numbers of headwater chub present (Voeltz 2002) and more recent survey data (Carveth 2007, Holt and Duffy 2005, and Kern 2008b) continues to support those rankings.

The current status of the headwater chub in the mainstem of Tonto Creek is based on limited surveys; however, Kern (2008a) did report multiple age classes present in the occupied reach between the waterfall below Bear Flat Campground and Hells Gate near the confluence with Haigler Creek. The status of the headwater chub below Hells Gate to Gisela is unknown, but were observed during visual surveys in May 2007 (Burger 2007) but specific numbers or distribution were not obtained. This additional information, while limited, may warrant a reevaluation of the status in Tonto Creek in the vicinity of Hells Gate.

Past surveys in Gunn Creek (Burger et al. 2002, Clarkson and Marsh 2006, and Evans 2009) indicated warmwater fish species were present along with headwater chub in the creek. Evans (2009) indicated that there might be a natural barrier that could assist in keeping nonnatives out of a portion of the occupied reach and additional work is needed there to document this barrier and the status of headwater chub and nonnative species present.

The presence of recruiting populations of nonnative crayfish, brown trout, rainbow trout, bullheads, and green sunfish in the Tonto Creek drainage is a significant adverse effect to

headwater chub populations (Voeltz 2002). Not all these species are established everywhere; however, they are widespread and over time may invade more locations (particularly crayfish).

In summary, the headwater chub occupying the Tonto Creek drainage contain several “stable-threatened” locations and several of “unstable-threatened” status. The survey data is supportive; however, most surveys represent a point in time, and while they confirmed recruitment was occurring, the actual stability of the populations based on repeated monitoring has not been achieved. These existing occupied waters are all threatened by multiple threats, including the presence of nonnative aquatic species and wildfire. It is also important to know that even though this species is commonly found throughout much of the middle portions of the drainage; it is considered extirpated from the upper portions and lower portions of the drainage.

### **B. Factors affecting the species’ environment within the action area**

Headwater chub in the Tonto Creek drainage have been affected by land management actions, wildfires, recreation and development of recreational facilities, and the introduction of nonnative aquatic species. In the lower reaches of the creek, improper livestock grazing groundwater pumping, water diversions and localized human developments are issues of concern.

The Spring Creek drainage was affected by the Picture Wildfire that reduced headwater chubs from Turkey Creek; however, the fire also reduced numbers of nonnative fish in the streams, and headwater chub rebounded in the burned areas after the fire.

The current status of the headwater chub in Tonto Creek below Bear Flat Campground is based on two recent surveys. Kern (2008a) documented multiple age classes present in the occupied reach between the waterfall and Hells Gate and in Haigler Creek from the waterfall below Alderwood Campground to the confluence with Tonto Creek at Hells Gate (Kern 2008b). Reproducing rainbow trout and brown trout were also observed. The status of the headwater chub below Hells Gate to Gisela is unknown, but they were observed during visual surveys in May 2007 (Burger 2007) but specific numbers or distribution was not obtained.

### **EFFECTS OF THE ACTION**

The proposed action is to stock catchable rainbow trout into Tonto Creek and Christopher Creek above Bear Flat Campground, and in Haigler Creek. Headwater chub are not present in any of the stocking sites (populations are considered extirpated [Voeltz 2002]) but are present in connected habitats downstream on Tonto and Haigler creeks. Stocked rainbow trout can, and do, move out of the stocking reaches during the stocking period, particularly in conjunction with monsoon rainfall events. This movement may augment the existing wild rainbow trout populations in occupied headwater chub habitats. The wild rainbow populations are recruiting but data to confirm this is lacking. Wild trout populations also exist within the stocking reaches, and individuals from those populations may also augment and support the trout in the occupied headwater chub habitats. The transition to triploid rainbow trout for stocking into the Tonto Creek basin will eliminate any reproductive support to the wild rainbow trout populations which may affect the persistence of these wild trout over time.

Rainbow trout and headwater chub both use pool habitats and feed on invertebrates. Young-of-the-year chubs are also pool dwellers and are vulnerable to trout predation. If headwater chub in Tonto Creek spawn at a similar time to those in Fossil Creek which begin to spawn in March, larval and YOY chubs would be available as prey to stocked trout moving out of the stocking reaches after stocking begins in April. Available survey data is unable to address the number of such stocked trout that may be present while young headwater chub are available as prey. The wild trout populations are present and are likely predators on young headwater chub and young trout are competitors. As noted previously, the relationship between the wild and stocked trout populations is unclear; however, indications are that the wild populations are self-sustaining at some locations. There are few overwintering stocked trout in Tonto Creek, and in the past, these could spawn with the wild trout in the spring. This would not occur under the proposed action, as only triploid rainbow trout would be stocked in this drainage once the three-year phase-in is complete.

In the stream reaches where headwater chub are most numerous (near Hells Gate on Tonto Creek and below the Marsh Creek confluence on Haigler Creek), rainbow trout are in lower numbers than in the reaches immediately above those sites where headwater chub numbers were lower. Since both species have similar habitat preferences, and no markedly different change in habitat were reported (Kern 2008a, 2008b), the reasons for this are unclear. Temperature may be a factor; however, the distances between the two trout dominated and headwater chub dominated reaches are short (less than six miles in both cases) although there are drops in elevation across the reaches that may affect temperatures during the summer. No rainbow trout were found at Hells Gate (Holycross et al. 2006, Kern 2008a) during the summer and only a few brown trout were captured. In Haigler Creek, both wild rainbow and brown trout were found at the lower end of the reach with the more numerous headwater chub (Kern 2008b) above the Tonto Creek confluence. Without additional elevation and temperature data, the reason for these shifts in abundance is unclear.

The role of stocked rainbow trout in maintaining the extant wild rainbow trout populations in headwater chub habitats is unknown. The wild trout are descendants of earlier stockings into these streams, and available information suggests they are self-sustaining within at least a portion of the headwater chub habitats. Movement of stocked rainbow trout from the upstream stocking reaches into headwater chub habitat down to Hells Gate likely occurs at some level, with the potential for competition for space and food, and predation on young headwater chub. If stocked rainbow trout do contribute to maintaining the wild populations, stocking of triploid rainbow trout will significantly reduce contribution to resident fish reproduction. The available survey data for the headwater chub populations in Haigler and Tonto creeks between 2000 and 2009 is very limited; what data there is indicates recruiting populations of headwater chub as evinced by multiple year classes, particularly in Haigler Creek.

Effects to headwater chub populations in Tonto Creek tributaries below Hells Gate from stocked rainbow trout are likely uncommon. Rainbow trout displaced by summer monsoon events are unlikely to persist long enough in the higher temperature reaches of the creek to have any meaningful effect on headwater chub. The overwintering rainbow trout are more likely to have transitioned to a natural diet, and when displaced by winter/spring flows, could persist in headwater chub habitats for some time until high temperatures removed them. This period may

overlap with the spawning season for headwater chub, providing opportunities for predation as well as competition for food and space. The number of such trout displaced, considering that they are few in number in the stocking reaches, is likely to be few.

Angler bycatch of headwater chub in Tonto Creek is unlikely due to the separation of the stocking reach (where most, if not all angling occurs) from occupied headwater chub habitat. In Haigler Creek, most angling takes place in the stocking reach above the waterfall barrier below Alderwood Campground. No headwater chub are present in the stocking reach. Some angling does take place below the waterfall; however, this is likely limited and most likely occurs nearer the falls than further downstream where headwater chub are more numerous and trout are rarer (Kern 2008b). Given these conditions, amount of bycatch is likely low.

## CUMULATIVE EFFECTS

The stocking sites are all on Tonto National Forest lands; however, there are some private lands used for residential purposes along the river in the occupied habitat area. Since most of the land within the action area is managed by the Forest Service; most activities that could potentially affect these species are Federal activities and subject to additional section 7 consultation. We are not aware of any additional development on the private lands along the river that could result in changes to conditions for headwater chub. We are concerned about illegal stocking of rainbow trout into Gordon Creek, as was documented in surveys there (Kern 2008c).

Use of live bait fish is illegal in the Tonto Creek stocking areas and downstream to Roosevelt Lake. Use of nonnative tiger salamanders as bait is legal; however, tiger salamanders are not used as bait for stocked trout so there is little incentive to bring them into the stocking reach.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to headwater chub populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon

by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect headwater chub. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

## CONCLUSION

After reviewing the current status of headwater chub, the environmental baseline for the action area, the effects of the proposed stocking actions and the cumulative effects, it is the AESO's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the headwater chub. No critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion for the following reason:

- The overall status of the headwater chub is not clearly understood. Recent survey data for most populations in Arizona is significantly lacking; however there is some recent (post-2008) survey and anecdotal information to assist in reviewing the status in those streams. Trends in New Mexico show declines in those populations. The assignment of recently discovered populations in the East Verde River drainage and Verde River drainage to headwater chub has not been verified by genetic and morphometric evaluations.
- The proposed action may affect five of the 23 extant occupied streams for headwater chub. All these stocking sites involving headwater chub are continuing sites, not new ones, so there are continuing adverse effects but no additional effects.
- The proposed action directly affects headwater chub in the East Verde River (including lower Ellison Creek), and Webber Creek as rainbow trout are stocked into the occupied habitat. Effects are related to increased competition for food and pool habitats and potential predation on YOY headwater chub. These occupied areas are currently rated as “unstable-threatened” but recent anecdotal information indicates headwater chub are common with multiple age classes in the stocking reach, which may warrant a change in rating to “stable-threatened.” The magnitude of the effects of stocked rainbow trout on headwater chub is unclear; however, recent information indicates the species is maintaining a recruiting population in the presence of both wild and stocked rainbow trout.

- Indirect effects may occur in Tonto Creek, Haigler Creek and possibly Marsh Creek if rainbow trout move out of the stocking sites into these occupied streams. Effects are related to increased competition for food and pool habitats and potential predation on YOY headwater chub. Tonto Creek is currently rated “unstable-threatened” with the other sites “stable-threatened.” Surveys in Tonto Creek did document few rainbow trout present and multiple age classes of headwater chub. The number of stocked rainbow trout that move out of the stocking sites is unknown; however, due to angling pressure at the stocking sites, it may not be a large number and effects may not be significant. Recent information indicates the species is maintaining a recruiting population in the presence of both wild and stocked rainbow trout.
- Effects from stocking rainbow trout at Green Valley Lake are unlikely to occur due to isolation of the Pine Creek and The Gorge occupied areas from the East Verde River and the limited amount of time any rainbow trout could be present in the system if they did escape from the lake.
- The transition to triploid rainbow trout by 2013 will eliminate any augmentation of the wild rainbow trout populations that may have occurred in the past in the East Verde River, Tonto Creek, or Haigler Creek.
- The renovation of Fossil Creek provided significant on-the-ground conservation for headwater chub that may be lost if the newly discovered smallmouth bass cannot be eliminated. Surveys in Arizona and New Mexico provide documentation of populations, and genetics work enables identification of populations of the species.
- Angler bycatch of headwater chub particularly in the East Verde River stocking site may result in some mortality to captured individuals. Available data on hooking mortality is unavailable; however, we do not believe the level of mortality is sufficient to cause declines in the overall numbers of headwater chub present in the stocking site. Additional angler education efforts are included in the conservation measures that are part of the proposed action.
- AGFD will provide for three populations either by securing existing threatened populations or establishing new conservation populations as a conservation measure as part of the proposed action.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR 17.3) to include significant



habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

The prohibitions against taking headwater chub found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for this species at this time. The proposed action, through the CAMP, is providing conservation measures directed to address potential take that may result from the proposed action. If and when the headwater chub is proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement at that time.

#### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

#### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for headwater chub contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery actions for headwater chub under the auspices of the CAMP provides conservation benefits to headwater chub that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

**New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)**

**DESCRIPTION OF THE PROPOSED ACTION**

The New Mexico meadow jumping mouse (jumping mouse) may be affected by stocking rainbow trout and Apache trout along the West Fork Little Colorado River at Greer, West Fork Little Colorado at Sheeps Crossing, and at the East Fork and West Fork Black River (Table 24). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 24: Stocking sites, sportfish species proposed for stocking, and potentially effected jumping mouse habitats (areas known to be occupied as a result of recent surveys are indicated with a ^)

| Stocking Complex/Site                  | Species stocked        | Jumping mouse site            |
|----------------------------------------|------------------------|-------------------------------|
| <i>Black River</i>                     |                        |                               |
| Big Lake                               | ONMY, ONAP, ONCL, SAFO | Three Forks^                  |
| East Fork Black River                  | ONAP, ONMY*            | Three Forks^                  |
| West Fork Black River                  | ONAP                   | West Fork Black River^        |
| <i>West Fork Little Colorado River</i> |                        |                               |
| West Fork LCR at Greer                 | ONMY, ONAP             | West Fork LCR, East Fork LCR^ |
| West Fork LCR Sheeps Crossing          | ONAP                   | West Fork LCR Sheeps Crossing |
| Lee Valley Lake                        | ONAP, THAR             | Lee Valley                    |

Conservation measures included in the proposed action

New Mexico meadow jumping mouse is a focus species for conservation in the proposed action. Because the effects of the proposed action are related to angler access and use of stocking sites, conservation actions are targeted on protection and enhancement of habitat areas.

AGFD shall provide protection from human access impacts (completed within three years), and if needed, enhancement actions for meadow jumping mouse habitats on AGFD-owned lands on the West Fork Black River (if needed, completed within five years).

AGFD shall coordinate with the ASNF on evaluations of effects to meadow jumping mouse habitat along the East and West Forks of the Little Colorado River. This measure will be implemented as needed.

The AGFD shall explore opportunities to manage for suitable meadow jumping mouse habitats at other AGFD-owned properties in the White Mountains (non-mandatory measure).

#### STATUS OF THE SPECIES (rangewide and/or recovery unit)

##### *Listing*

The New Mexico meadow jumping mouse became a candidate species under the Endangered Species Act in 2007 (USFWS 2007f).

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the jumping mouse. This information was taken from the New Mexico Recovery Plan (NMGFD 2008), the most recent conservation status documents prepared by USFWS (USFWS 2009h, 2010f), and various papers by Dr. Jennifer Frey (Frey 2005, 2006 a through d, 2008a and b, 2009a and b, 2010). Information in these documents is incorporated by reference.

##### *Life history*

The jumping mouse is generally nocturnal, but occasionally diurnal. It is active only during the growing season of the grasses and forbs on which it depends. During the growing season, the jumping mouse accumulates fat reserves by consuming seeds. Preparation for hibernation (weight gain, nest building) seems to be triggered by day length. The jumping mouse hibernates about 9 months out of the year, longer than most other mammals (Morrison 1990, VanPelt 1993, Frey 2005).

The longest known lifespan of this species in the wild is 3 years, with an average lifespan less than 1 year (Smith 1999). Females breed shortly after emerging from hibernation and may give birth to 2 to 7 young after an average 19 day gestation. One litter is produced each year, usually between May and September. Young are fully developed and weaned at 4 weeks (Van Pelt 1993). The female provides all the care for their young until they are weaned and independent. Females born in the spring are sexually reproductive at 2 months of age.

##### *Habitat use*

The jumping mouse is a habitat specialist (Frey 2006d, Frey and Malaney 2009, Frey 2011). It nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet (ft) (2,438 meters (m)) (Frey 2006d). The jumping mouse appears to only utilize two riparian community types: 1) persistent emergent herbaceous wetlands (i.e., beaked sedge and reed canarygrass alliances); and 2) scrub-shrub wetlands (riparian areas along perennial streams that are composed of willows and alders) (Frey 2005). It especially uses microhabitats of patches or stringers of tall dense sedges on moist soil along the edge of permanent water. Home ranges vary between 0.37 and 2.7 ac (0.15 and 1.1 ha) and may overlap (Smith 1999).

#### Current distribution

The jumping mouse has been documented as having occurred at 98 localities. The historical distribution likely included riparian wetlands along the eastern front of the Sangre de Cristo Mountains from southern Colorado to central New Mexico. It was present throughout both the Rio Grande and Canadian River drainages in southern Colorado and New Mexico. Its historical distribution within the Pecos River Basin in New Mexico is unknown, but the species currently occurs in the Pecos River Basin, as evidenced by its presence in the Penasco River Watershed in the Sacramento Mountains (Frey 2006d; Frey and Malaney 2009). Hafner et al. (1981) reported this subspecies at 14 localities in New Mexico in the San Juan, Sangre de Cristo, Jemez, and Sacramento Mountains, and in the Rio Grande Valley between Española and Bosque del Apache National Wildlife Refuge. Hink and Ohmart (1984) surveyed the Rio Grande from Espanola to San Acacia, New Mexico, and only found the 4 jumping mouse present at Isleta Marsh on the Pueblo of Isleta. The jumping mouse was found historically in the middle Rio Grande Valley at Bosque del Apache National Wildlife Refuge, Casa Colorado Waterfowl Area, Isleta Pueblo, and on the Ohkay Owingeh Pueblo (formerly San Juan Pueblo) and along the Rio Chama near Espanola, New Mexico (Morrison 1988). Morrison (1992) subsequently verified the presence of the jumping mouse in most localities reported by Hafner et al. (1981), and located new populations in the Jemez Mountains (eight localities in the upper Guadalupe River drainage), the Rio Grande Valley (two new localities near Española and Isleta), the Rio Chama (one new locality), and in the Sacramento Mountains (13 localities along tributaries of the Rio Peñasco). In Arizona, the species was found in the White Mountains, southern Apache County, and in northern Greenlee County (Hafner et al. 1981; VanPelt 1993; Underwood 2007, Frey 2008).

Of the original 103 known historical localities, 95 have been surveyed since the early to mid-1990s. Of the 95 historical localities surveyed, currently only 16 are extant, 9 in New Mexico (including one that is contiguous with the Colorado locality) and 7 in Arizona (Frey 2006a, 2006d, 2008a, b, Frey et al. 2007a, Underwood 2007). The known extant locations are: two localities in the Sangre de Cristo Mountains along the border of Colorado and New Mexico; five localities in the Jemez Mountains, New Mexico; two localities in the Sacramento Mountains, New Mexico; and seven localities in the White Mountains, Arizona. The species is no longer found along the Rio Grande at Espanola, Albuquerque, Socorro, or the Carson National Forest, New Mexico (Frey 2003, 2006c, Frey et al. 2007, USBR 2007, Wildearth Guardians 2008).

The current distribution is disjunct and relictual due to habitat fragmentation (Frey 2005, 2006d, Frey and Malaney 2009). The five Jemez Mountains localities are separated from one another by

an average of 4.4 miles (mi) (7.1 kilometers (km), the two Sacramento Mountains localities are separated from one another by 20 mi (32 km), and the two Sangre de Cristo localities are separated from one another by 71 mi (114 km). The extant localities in the White Mountains of Arizona are over 200 mi (322 km) from the nearest New Mexico locality. In addition to being widely separated, these areas are quite small: half are only a few acres in size and are widely separated from other occupied localities (Frey 2005a, 2006d). Three localities with extant populations in New Mexico contain approximately 25 ac (10 ha) of habitat in total and are much less fragmented. These three areas are managed by New Mexico State Parks, with one area being contiguous with a state wildlife area in Colorado and these populations are considered secure although more information is needed on the extent of habitat.

The occupancy of the four unsurveyed historical localities in New Mexico is unknown at this time. Two of the four historical localities in New Mexico likely still contain suitable habitat for the jumping mouse (Frey 2006c). To our knowledge no one has visited the remaining two historical localities in New Mexico since 1987, as these areas are on Pueblo lands (Frey 2006c). Ten of the 21 known historical locations and 10 new locations in potential habitat in Arizona were surveyed in 2008 (Frey 2008). The jumping mouse was documented at 7 of the 20 survey locations (5 historical and 2 new locations) (Frey 2008). This represents the largest survey ever for the species in Arizona (Frey 2008). Additional surveys in 2009 at three historical and 10 new localities found jumping mice at one historical and one new site (Frey 2009, 2010). The status of the jumping mouse on the Fort Apache Indian Reservation (White Mountain Apache Tribe) in the North Fork White River and Big Bonito Creek are unknown. These sites were included in original compilations for sites in Arizona (Hoffmeister 1986) but have not been surveyed since.

#### Population Status:

The populations of the jumping mouse at the extant localities are likely quite low (Frey 2005, Frey and Malaney 2009). Table 25 summarizes surveys conducted recently, which documented a substantial decline in the number of occupied localities and suitable habitat across the range of the species in New Mexico and Arizona (Frey 2005, 2006b, 2008a, b, Underwood 2007). Frey's jumping mouse surveys in New Mexico during a 4 year period from 2003-2006 involved 82 historically occupied sites and 10 localities that appeared to have the highest quality potentially suitable habitat. Only 36 individual jumping mice were caught during a total of 13,175 trap nights. Surveys in 2008 at 10 historical localities in the White Mountains of Arizona found jumping mice persisted at half of the historical sites (Frey 2008). Extensive survey work was conducted in 2008, with an additional two localities documented (Frey 2008) and another new locality documented in 2009 (Frey 2009, 2010).

Table 25: Results of recent surveys for jumping mice.

| Area | Number Localities Extant (No. individuals captured) | Year of Most Recent Surveys (No. localities trapped/ Trap nights) | Number Historical Localities | Notes |
|------|-----------------------------------------------------|-------------------------------------------------------------------|------------------------------|-------|
|      |                                                     |                                                                   |                              |       |

|                                    |         |                 |    |                                       |
|------------------------------------|---------|-----------------|----|---------------------------------------|
| Sangre de Cristo Mountains (CO/NM) | 2 (3)   | 2006 (27/ 4083) | 7  | 1 newly discovered locality in 2006   |
| Carson National Forest (NM)        | 0 (0)   | 2003(16/ 4564)  | 3  |                                       |
| Jemez Mountains (NM)               | 5 (9)   | 2005 (19/ 2153) | 14 |                                       |
| Sacramento Mountains (NM)          | 2 (2)   | 2005 (18/ 2375) | 15 |                                       |
| White Mountains (AZ)               | 7 (38)  | 2008 (20/ 5969) | 21 | 2 newly discovered localities in 2008 |
| White Mountains (AZ)               | 2 (2)   | 2009 (13/4742)  | 3  | 1 newly discovered locality in 2009   |
| Total                              | 16 (52) | (113/ 23886)    | 63 |                                       |

As noted above, 8 of the 16 localities where the species is known to persist are only a few acres in size and are widely separated from other occupied localities (Frey 2005a, 2006d); based on the very limited habitat at these sites we expect the populations there to be quite small. Three localities with extant populations in New Mexico contain approximately 25 ac (10 ha) of habitat each and are much less fragmented, and we expect they contain relatively larger populations than the other extant areas. These three areas are managed by New Mexico State Parks, with one area being contiguous with a state wildlife area in Colorado. The size of the other five localities in Arizona has not been quantified (Frey 2008).

In summary, populations of the jumping mouse are likely quite small at eight extant locations with only a few acres of habitat. While relatively larger, populations are unlikely to be substantial in the other three areas in New Mexico because they are only about 25 ac (10 ha) in size, and it is unlikely that these areas support large populations even if the home ranges overlap. Further, populations appear to be in decline. Surveys from the late 1980s and early 1990s (Morrison 1988a, 1991, 1992) indicated a decline in the number of occupied localities, and more recent surveys (Frey 2003, 2005, 2006d, Frey and Malaney 2009) indicate both fewer mice and fewer occupied localities since that time. In Arizona, an additional five localities were documented in 2008 (Frey 2008) and one in 2009 (Frey 2009, 2010). Habitat data was analyzed for those locations (Frey 2011).

Currently in Arizona the jumping mouse is only known to occur in Apache and Greenlee Counties; however, there may be an old record from the Verde River near Camp Verde but that

has not been confirmed (Frey 2011). The extant localities in the White Mountains of Arizona are over 200 mi from the nearest New Mexico locality. In addition to being widely separated, these areas are quite small: half are only a few acres in size and are widely separated from other occupied localities (Frey 2005a, 2006d).

New Mexico meadow jumping mice were recently captured at several new locations: the East Fork Little Colorado River below Montlure Camp (Frey 2008, 2009a, b), at Thompson Ranch along the extreme upper West Fork Black River (Frey 2009) and near Corduroy Creek near Ackre Lake (Frey 2010) (Table 26). Historical locations on the West Fork LCR (Sheep's Crossing and near Greer) were not surveyed by Frey in 2008 or 2009 because of heavy angler use and the risk that traps would be removed. The mouse was also not detected in Lee Valley Creek above Lee Valley Reservoir or at known historical locations around Phelps Botanical Area nearby in 2009 (Frey 2010). Jumping mice are not believed to persist at LCR West Fork at Sheep's Crossing and near Greer due to currently degraded habitat conditions (Frey 2011). New Mexico meadow jumping mice were confirmed present in the alternative sampling site in the East Fork LCR below Montlure Camp.

In the Black River watershed, there are several inhabited areas. Historical locations occurred on the East Fork Black River at Three Forks and on the West Fork Black River near the FR 68 crossing and at the confluence with Home Creek in the lower West Fork. They supported populations of the mouse in 2008 (Frey 2008). Jumping mice were also found at Boggy and Centerfire Creeks in 2008 and on Corduroy Creek in 2009. Jumping mice were also found in upper West Fork Black River at Thompson Ranch in 2009 (Frey 2010).

Jumping mice were also confirmed present in the San Francisco River drainage near Talwiwi Creek and Upper San Francisco River both near Alpine, and along Nutrioso Creek one mile overland from Hulsey Lake (Frey 2008) in the Little Colorado River drainage, and on Campbell Blue Creek in the Blue River drainage. The status of the jumping mouse on the Fort Apache Indian Reservation is unknown.

Table 26: Jumping mouse capture per trap night for surveys in Arizona in 2008 and 2009 (sites with no captures not included)

| Site name                                     | Number jumping mice captured             | Number of trap nights | Captures per trap night |
|-----------------------------------------------|------------------------------------------|-----------------------|-------------------------|
| East Fork Little Colorado River/Montlure Camp | 5 (one additional seen but not captured) | 200                   | 1/40                    |
| East Fork Black River/Three Forks             | 7                                        | 400                   | 1/57                    |
| Nutrioso Creek above Nutrioso                 | 3                                        | 280                   | 1/93                    |
| Lower Tawiwi Creek                            | 1                                        | 300                   | 1/300                   |
| Upper San Francisco                           | 6 (one recapture so                      | 300                   | 1/60                    |

|                                               |                                                      |     |       |
|-----------------------------------------------|------------------------------------------------------|-----|-------|
| River                                         | total is 5 individuals                               |     |       |
| Black River/Boggy Creek                       | 4 (includes one recapture so total is 3 individuals) | 300 | 1/100 |
| Black River/Centerfire Creek                  | 3                                                    | 300 | 1/100 |
| Black River/Corduoy Creek (2009)              | 1                                                    | 400 | 1/400 |
| West Fork Black River Thompson Ranch (2009)   | 1                                                    | 140 | 1/140 |
| West Fork Black River Middle (FR 68 crossing) | 3                                                    | 350 | 1/116 |
| West Fork Black River lower (Home Creek)      | 2                                                    | 200 | 1/100 |
| Campbell Blue Creek middle                    | 3                                                    | 120 | 1/40  |

### Threats

The jumping mouse is an obligate riparian species known only from two riparian types: persistent emergent herbaceous vegetation (beaked sedge and reed canarygrass alliances) and scrub-shrub wetland (willow and alder alliances) (Frey 2006d). Several risk factors related to habitat have been identified, including excessive grazing pressure from livestock, water use and management, highway reconstruction, development, recreation, and beaver removal (Morrison 1990b, Morrison 1991, Frey 2005a, Frey 2006, 2006d, USFS 2006, Frey and Malaney 2009).

The 2009 candidate assessment form goes into considerable detail about threats facing the species (USFWS 2009h). The following is excerpted from that document and discusses the effects of recreation.

The development of streamside trails and large bare compacted areas used for camping has been and continues to be reported throughout historic jumping mouse habitat in areas of the Jemez Mountains (Frey 2005a). Erect riparian vegetation is readily damaged by trampling. Streamside areas, which may also be suitable habitat or support the jumping mouse, are favored locations for many campers (Frey 2005a). Frey (2005) observed a variety of these impacts (e.g., barren ground, trampled plants, multiple trails, and vehicle tracking from all-terrain vehicles and motorcycles) in areas that were historically occupied by the jumping mouse. The demand for developed and dispersed camping and recreation, which is generally greatest from May through September (the same activity period for the jumping mouse), often exceeds capacity of the Jemez and Sacramento National Forests. Four of the extant localities are currently located within campgrounds, while two extant localities are immediately adjacent to areas heavily used by



dispersed camping. These six extant localities are surrounded by riparian habitat that is currently fragmented or unsuitable for the jumping mouse due, in part, to recreational impacts. Recreational use in these areas will likely continue to remove tall, dense riparian vegetation from areas adjacent to the extant localities. These impacts likely are reducing the quality or quantity of suitable habitat in and around developed campgrounds or undeveloped campsites known to support the jumping mouse.

One jumping mouse population in the Sangre de Cristo Mountains is located within a heavily-used State Park. Similarly, Frey (2005) reported that jumping mice were found within a small wet meadow that was adjacent to a campground in the Jemez Mountains, but because of saturated soils and marshy conditions, had limited human use and this population may be secure. From these observations, it appears that the species is able to persist in circumstances when microhabitat conditions create dense riparian vegetation or saturated soils that are difficult for humans to traverse.

Recreational use also affects the jumping mouse populations along the West Fork Little Colorado River and West Fork Black River in Arizona (Frey 2008a, 2009). Two historical sites, the West Fork Little Colorado River Greer and Sheeps Crossing have not been surveyed due to the high recreational use of the areas that precludes use of traps (Frey 2009). Further, the habitat at Sheeps Crossing is so degraded, that there is little cover for the traps, and habitat conditions may no longer be suitable for jumping mice.

In conclusion, we believe that impacts to the jumping mouse from these recreational uses will continue to destroy or modify jumping mouse habitat, and in concert with other threats, results in this species warranting listing. The jumping mouse has a listing priority of 3, which means threats are of high magnitude and are imminent. As a subspecies, the highest listing priority the jumping mouse can attain is a 3.

Wildfire has not previously been identified as a concern for the mouse; however, it can have significant adverse effects to jumping mouse habitat. With the exception of the upper West Fork Black River site near Thompson Ranch and Talwiwi Creek lower (Frey 1011) all Arizona currently occupied jumping mouse locations are within the burn perimeter of the 2011 Wallow Fire on the ASNF. The extent of damage to mouse habitats along the streams by the fire itself is not yet well known; however, the wet, grassy areas are less likely to have been seriously burned than dryer vegetation types while post-fire runoff may carry sediments to these habitats that may lodge in the grasses and damage habitat. For the purposes of this BCO, we assume that all jumping mouse populations in the fire perimeter remain extant.

#### Conservation actions

Most recent biological information has been obtained by surveys at historical locations and sites showing potential for the jumping mouse to be present. New Mexico has a recovery plan for the jumping mouse (NMGFD 2009) that contains recommendations for conservation actions to be implemented in the future. In addition, the FWS in New Mexico has identified conservation actions needed for the species (USFWS 2009h). None of the non-survey related measures identified in these two documents have been implemented.

The ASNF has put in place measures to manage riparian areas occupied by the jumping mouse, particularly in eliminating livestock use from all but two historical and all currently occupied habitats. Identification of management options for the jumping mouse has been discussed with Dr. Jennifer Frey and the ASNF has and continues to support survey work. The Three Forks Special Closure area includes the occupied habitat for the jumping mouse at this location, and no recreational activities are allowed in the closed area. This closure protects the occupied jumping mouse habitat from trampling and other effects of recreational activity. Reduction in fuel loading through the White Mountain Stewardship program and the Four Forests Restoration Initiative has reduced wildfire risks on portions of the ASNF and these programs are continuing. The ASNF recently completed planning for a land exchange that would bring Thompson Ranch and Rancho Alegra, the latter adjacent to P-S Ranch which is owned by the AGFD, into Federal ownership. These actions may enable conservation actions to occur for jumping mice at these locations.

#### *Previous consultations*

Since the jumping mouse is not currently listed, it is only considered in intra-Service section 7 consultations or those with the National Park Service. It has been considered in land management planning by the ASNF in Arizona but little has been accomplished on Forest Service lands in New Mexico (USFWS 2009), but all protections for the jumping mouse are voluntary.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Portions of the known range of the jumping mouse in Arizona correspond with the Black River Complex stocking sites and the West Fork Little Colorado River stocking sites. Not all sites within those two complexes are in proximity to jumping mice, or fish from those sites are not likely to reach stream sections where jumping mouse habitat exists. The stocking sites of concern were listed in Table 22.

#### *Black River*

#### **Description of the Action Area**

The Black River complex action area is along the East and West Forks of the Black River.

#### **A. Status of the species within the action area**

As described in the rangewide status, populations of jumping mice are found in the Black River at Three Forks on the East Fork Black River, and at three localities in the West Fork Black River. The East Fork population appears to be the most robust, judging only from trap night captures (one mouse per 57 trap nights) versus one per 100 and 116 trap nights at the two West Fork locations. The middle West Fork site is partially within the ASNF's West Fork Campground, which is a heavily used recreational area, and AGFD's P-S Ranch, which has significantly less use. The lower site is near Home Creek, near to the confluence with the East Fork Black River and is on ASNF lands and AGFD's P-S Ranch. There is no developed recreation site nearby the lower site, but there is road access. Home Creek is frequently dry, so the only water supporting jumping mouse habitat is that from the West Fork itself, which is perennial.

Occupied habitat for the jumping mouse exists in at least the lower end of the stocking reach near the crossing of FR 68 and downstream below the reach. In 2008, three jumping mice were captured here. The extent of suitable habitat for the jumping mouse on the West Fork Black River above and below the stocking reach is unknown; jumping mice are known from several miles upstream near Thompson Ranch, and below the reach below FR 68 to near the confluence with Home Creek. Frey (2011) indicated that there was at least six km (2.7 mi) of good quality habitat along the middle and lower portion of the West Fork with a high probability of persistence of the jumping mouse population there.

Surveys for jumping mice along the West Fork Black River have occurred over several decades. The campground area and upper portion of P-S Ranch was surveyed in 1933 (one jumping mouse found), 1979 (13 jumping mice found), and in 2008 (three jumping mice found). Other nearby West Fork locations in 1933 found nine jumping mice, with the P-S Ranch site documenting nine jumping mice in 1987 and one in 1996. Three jumping mice were captured in the middle West Fork in 2008, two jumping were captured near Home Creek in 2008 and one at Thompson Ranch in 2009 (Frey 2008, 2009a). While these data are too sparse to form conclusions on the population trends for jumping mice at this site, the downward path of captures is of concern. Frey (2008a) put in 350 trap nights on the campground/P-S Ranch transect to capture three jumping mice, or one mouse per 116 trap nights (Table 26). Other sites in Arizona surveyed by Frey at the same time varied from one mouse per 40 trap nights (East Fork Little Colorado River at Montlure Camp) to one in 300 trap nights (Upper Talwiwi Creek).

## **B. Factors affecting the species' environment within the action area**

The jumping mouse is affected by improper livestock grazing, wildfires, forestry practices, road construction and maintenance, and recreational activities along streams where the jumping mouse lives. All these activities can result in the removal of the vegetation community needed by the jumping mouse through trampling of the area by people, vehicles, or animals, grazing by animals, fire and subsequent erosion and sedimentation or erosion from improper road crossings. The jumping mouse is found primarily on lands of the Apache-Sitgreaves National Forests, with some state land and private lands also potentially supporting habitat. The isolated nature of most jumping mouse populations from other populations increases the risk of local extirpation without subsequent recolonization that can eliminate any of the remaining occupied areas.

The occupied jumping mouse habitats in Arizona overlap to some extent with Apache trout

recovery streams in the West Fork Little Colorado River drainage and the Black River drainage. Construction of barriers on streams to block nonnative species from accessing the stream may disturb or destroy jumping mouse habitat, and management activities along the length of the streams, particularly during chemical renovations that require access to many points along the stream banks, may also affect habitat conditions. Surveys for native aquatic species in the vicinity of Three Forks on the East Fork of the Black River may also impact jumping mouse habitat if vegetation is trampled during those efforts.

After the Wallow Fire, runoff events from the summer rains and larger winter storms are expected to carry ash and sediment from the burned hillsides into some areas of jumping mouse habitat along streams within the fire perimeter. The distribution and effects of such flows will vary depending on the severity of the burn on the watershed for that stream, the amount of rainfall received, the topography, and other factors. The effects of such flows on the grassy margins where the jumping mouse lives can include: deposition of sediment and ash within the grass area, clogging spaces needed for movement within the habitat and burying seeds and seed heads; burial of dens or hibernacula (the fire occurred in June when the jumping mouse is active and young are being born and reared); and stream bank erosion that may also remove vegetation or lower the water table sufficiently that the grasses and sedges are less able to create habitat. With the very small numbers of jumping mice present at most locations, any significant habitat-altering event, or one that reduces foraging opportunity during the limited period the jumping mouse is active, could have devastating effects to the population. However, any prediction of the overall effects of such future events is speculative.

We believe the aggregate effects of land management activities under the purview of the Forest Service and contributions from other activities on federal, state, and private lands, exacerbated by recent drought and wildfire risks are responsible for the present precarious status of the jumping mouse in the action area.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

The act of stocking sportfish species at the stocking sites listed in Table 24 does not have direct effects to the jumping mouse except if hatchery trucks or by-hand transport of fish from the trucks crosses habitat for jumping mice and tramples or otherwise disturbs the vegetation community. Most access points for hatchery trucks are already disturbed by a road, bridge, campground, boat launch ramp, or other physical modification, so it is unlikely that jumping mouse habitat is affected by this action. The recovery of jumping mouse habitats in those sites is precluded by maintenance of those features.

The primary effect to jumping mouse and their habitat related to the proposed action is the presence of anglers in jumping mouse habitat while pursuing stocked sportfish. The probability that anglers would be in jumping mouse habitat is specific to each site, and is based on the proximity of habitat to the area where stocked fish are stocked or can move post-stocking and where anglers are likely to follow them.

Human access to mouse habitat results in trampling of vegetation, fragmentation of habitat patches, and soil compaction that degrades or eliminates habitat for the jumping mouse. Since the jumping mouse has a limited active period, quality habitat for foraging must be available for the mouse to get sufficient food to rear young and survive hibernation (USFWS 2009h). There is also an increased risk of predation if the mice must cross trails or other openings to reach habitat patches. Since the jumping mouse is active at night when recreationists are not present, there is little to no actual disturbance of the jumping mouse from presence of people.

The jumping mouse population at Three Forks on the East Fork Black River is unlikely to be affected by anglers pursuing stocked trouts at Big Lake. While Big Lake can spill, and fish from the lake can access the Three Forks site, it is unlikely that the anglers who fish in the vicinity of Three Forks are pursuing stocked sportfish. The wild populations of nonnative trouts present in the Three Forks area are the result of past stocking efforts, and are not maintained by the occasional escaped trout from the lake. However, this area is easily accessed by road, and there are other recreationists present that may be impacting jumping mouse habitat in the area.

Similarly, anglers pursuing trout stocked into the East Fork Black River stocking site are unlikely to travel up to Three Forks in search of those stocked trout. It is possible for trout from the downstream stocking reach to access this area; one Apache trout was documented in 2008 (Robinson et al. 2008). To access the jumping mouse habitat area, an angler would have to walk upstream at least two miles and would be out of the stocking reach. There are wild brown and rainbow trout in the reach, and those would be the fish being pursued.

The situation at the West Fork Black River has jumping mouse habitat in the stocking site boundaries in the middle West Fork site. The stocking site extends from the FR 68a Bridge 1.4 miles downstream to the boundary of P-S Ranch (which begins downstream of the FR 68 crossing). The West Fork Campground is in the stocking reach. Although the presence of the campground will attract recreationists who are not anglers, the campground is known as a fish stocking area, and AGFD acknowledges that stocking here is beneficial for Apache trout recovery as stocking reduces the likelihood of introductions of undesirable fish to create a fishery. It is likely that a considerable amount of the recreational use of this area is from anglers or family members of anglers who would not be present at this site otherwise. The proposed action is for 20,000 stocked fish per year, which provided over 20,000 angler use days in 2001. Stockings would be from May through September, encompassing the active period of the jumping mouse. The amount of suitable habitat in the stocking reach is unknown; however, information from Frey (2011) indicates that there is good quality habitat along at least six km (2.7 mi) of the middle and lower West Fork, and this area of good habitat is likely not in the campground area where there is heavy recreational use. The degraded habitat on the ASNF lands at the stocking site are likely not supporting the jumping mouse at this time while the AGFD lands may be where the good habitat remains.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

With the land exchange on the Black River, only the AGFD lands at P-S Ranch are not in Federal ownership in that drainage. The area in private ownership on the West Fork Little Colorado River around Greer was increased by that land exchange; however, the Federal lands being exchanged were not along the river so likely did not support jumping mouse habitat. Greer is an active town that showcases its recreational opportunities to promote business. Additional homes can be built on the former Federal lands that may increase the amount of recreational use of the area and increase the existing levels of effect on the jumping mouse there.

### *Little Colorado River*

#### **Description of the Action Area**

The West Fork Little Colorado River action area encompasses all stream reaches above the confluence of the West Fork with the South Fork of the Little Colorado River. This area includes historical and occupied habitats for the jumping mouse in this drainage.

#### **A. Status of the species within the action area**

The jumping mouse was not found at any historical habitat areas in the West Fork Little Colorado drainage during 2008 and 2009 (Frey 2008a, 2009). Two historical areas along the West Fork proper were not surveyed due to high recreational use and limited habitat for trap concealment and habitat values there were degraded (Frey 2009a). Jumping mice were found at a new East Fork Little Colorado River site upstream from its confluence with the West Fork (Frey 2008a), a site that must have shown less recreational use as trapping was conducted here. This appears to be a robust population, with one mouse captured per 40 trap nights. The amount of habitat present is limited to 0.4 km (.018 mi) but is of very high quality (Frey 2011). This area is near Montlure Camp, which was damaged during the Wallow Fire.

#### **B. Factors affecting the species' environment within the action area**

The jumping mouse is affected by improper livestock grazing, wildfires, forestry practices, road construction and maintenance, and recreational activities along streams where the jumping mouse lives. All these activities can result in the removal of the vegetation community needed by the jumping mouse through trampling of the area by people, vehicles, or animals, grazing by animals, fire and subsequent erosion and sedimentation or erosion from improper road crossings. The jumping mouse is found primarily on lands of the ASNF, with some state land and private lands also potentially supporting habitat. The isolated nature of most jumping mouse

populations from other populations increases the risk of local extirpation without subsequent recolonization that can eliminate any of the remaining occupied areas.

The occupied jumping mouse habitats in Arizona overlap to some extent with Apache trout recovery streams in the West Fork Little Colorado River drainage and the Black River drainage. Construction of barriers on streams to block nonnative species from accessing the stream may disturb or destroy jumping mouse habitat, and management activities along the length of the streams, particularly during chemical renovations that require access to many points along the stream banks, may also affect habitat conditions. Surveys for native aquatic species in the vicinity of Three Forks on the East Fork of the Black River may also impact jumping mouse habitat if vegetation is trampled during those efforts.

The Wallow Fire may have impacted the only currently known jumping mouse population along the East Fork of the Little Colorado River near Montlure Camp. The hillsides and a portion of the camp structure near the stream were burned, and as described for the Black River habitat sites, post-fire runoff is a concern. The loss of the Montlure jumping mouse population could result in the extirpation of the species from this portion of the Little Colorado River drainage.

#### EFFECTS OF THE ACTION

Lee Valley Creek above Lee Valley Lake is perennial, and fish stocked into the lake can access the portion of the creek below a fish barrier. The creek is very small, and while it is a recovery stream for Apache trout, it is not currently open for angling. The closed status of the creek above the lake make it unlikely that anglers pursuing stocked Apache trout in the lake would move above it to fish.

The historical location for jumping mice at Lee Valley Lake is upstream of the lake along Lee Valley Creek. This area was surveyed in 2009 and no jumping mice were present, however, the amount of effort, at 280 trap nights, was lower than for other sites due to logistical issues (Frey 2010). The wetted area below Lee Valley Lake Dam was also surveyed in 2009 with 474 trap nights with no jumping mice captured (Frey 2009a). The quality of the habitat above and below the lake is unreported.

The West Fork Little Colorado River Sheeps Crossing is a known historical location, with the last documented survey in 1987 when five jumping mice were captured (Dodd 1987). The 1987 record may have included information on habitat conditions, but we have been unable to locate it. Dr. Jennifer Frey did not survey the site in 2008 or 2009, citing the high recreational use and the degraded habitat that in combination, did not allow for effective small mammal trapping. In her report 2011 report on habitat quality (Frey 2011), she indicates that the current conditions are unlikely to support jumping mice at this location. Anglers are not the only recreationists present along this site; there is paved road access at the lower end of the site and the hiking trail to Mount Baldy parallels the river through the stocking site. The river above the stocking reach is open for fishing for wild or stocked Apache trout, so anglers may go further upstream in pursuit of stocked Apache trout. There is also a foot trail along the river from Greer that leads to the stocking site. This is a day-use area only, so human disturbance at night is not an issue here. Annual stocking of 12,000 Apache trout here supports approximately 10,000 angler use days

during the May through September stocking season, which overlaps with the jumping mouse active season.

The percentage of recreationist use associated with the sportfish stocking versus associated with other uses (picnicking, hiking) is unclear. The West Fork Trail to Mount Baldy is heavily used, with the two miles it runs along the river the most used section. The ASNF believes this may be the most heavily used trail on the Forest (ASNF 2010). Depending on the location of the stocking reach, the trail, and the historical habitats, separating the ongoing damage due to recreation or anglers may or may not be possible.

The historical habitat area along the West Fork Little Colorado River near Greer was also not surveyed due to high recreational use, and the alternative site on the lower East Fork of the Little Colorado River was substituted (Frey 2008). The West Fork Little Colorado River at Greer stocking site includes reaches of the West and East Forks; with the East Fork stocking site overlapping the jumping mouse survey site near Montlure Camp. The Montlure Camp survey site tied with Campbell Blue Creek for the highest per trap night capture (one mouse per 40 trap nights) rate of any site (Frey 2008a). The extent and quality of jumping mouse habitat along the East Fork is undocumented, as is the status of the habitat along the West Fork above and below Greer. As with the Sheeps Crossing site, there are other recreational activities along the East and West Forks that have effects to habitat, including hiking on trails paralleling the rivers. Habitat quality along the West Fork was not conducive to jumping mice occupancy (Frey 2011). Depending on the location of the stocking reach, the trail, and the historical or newly identified jumping mice locations, separating the ongoing damage due to recreation or anglers may or may not be possible.

## CUMULATIVE EFFECTS

There is a considerable amount of private land through the action area, with much of the West Fork privately owned. ASNF lands are along the East Fork and Lee Valley Creek. Recreational use along the East Fork and the upper West Fork on private lands has significant effects.

## CONCLUSION

After reviewing the current status of the New Mexico meadow jumping mouse, the environmental baseline for the action area, the effects of the proposed fish stocking program and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species. The jumping mouse is not a listed species, so no critical habitat has been designated.

We present this conclusion on the jumping mouse for the following reasons:

- The status of the jumping mouse across its range shows evidence of continuing declines, and recent survey data for Arizona supports data from New Mexico in this respect. The number of new populations found is fewer than the number of historical populations that may have been extirpated; however, complete surveys of all potential habitats have not been initiated, so additional populations may be present. Active interest in management



of the jumping mouse on the ASNF, particularly to eliminate effects from livestock grazing, provides considerable benefit for jumping mice habitats in the excluded areas. Efforts in New Mexico to address threats and provide conservation through the recovery plan have had limited success to date. Jumping mouse populations in Arizona were affected by the Wallow Fire, and their status is currently unknown, as is the status of their habitat after post-fire runoff events began to occur. The limited data available does not indicate that occupied habitats were entirely destroyed by the fire, and the amount of damage from runoff occurring in the next year or so while stabilizing vegetation returns to burned areas is unknown. The ASNF is, through the BAER program, working to stabilize areas of important wildlife habitat and reduce runoff damage.

- The continuation of sportfish stocking under the proposed action will perpetuate the habitat degradation occurring at the stocking sites at the campground on the West Fork Black River and along the West Fork Little Colorado River. The degraded habitat conditions currently documented at these sites by Frey (2011) and in her other reports (2008, 2009a, 2010) do not support these sites being currently occupied by the jumping mouse, whereas the P-S Ranch property owned by AGFD contains suitable habitat for the mouse. Continuation of stocking at these sites will not result in additional losses of occupied habitat over the baseline conditions that resulted from past recreational activities. As these are developed recreational sites, it is unlikely that future conservation actions for the jumping mouse would be considered for these locations. The CAMP does provide for AGFD to work with ASNF to coordinate on evaluations of effects of recreation on jumping mouse habitat in these two areas as needed.
- The majority of the jumping mouse habitat on the middle and lower West Fork Black River is not affected by the proposed action, and the habitat is in very good condition and is sufficient in extent to allow persistence of the jumping mouse population there (Frey 2011). The middle and lower West Fork areas were affected to some extent by the Wallow Fire. The ASNF is, through the BAER program, working to stabilize areas of important wildlife habitat and reduce runoff damage.
- The jumping mouse population at the lower East Fork Little Colorado River appears to be robust, however, only one survey has ever been done there, and the amount of habitat is very limited such that persistence probability is low (Frey 2011). This area may contain the last jumping mouse population in this portion of the Little Colorado River drainage, and it was affected to some level by the Wallow Fire. The other population in the drainage, on Nutrioso Creek is small with 1.4 km (0.6 mi) of good quality suitable habitat (Frey 2011). Continuing effects of human use at the East Fork Little Colorado River may, over the near term, reduce the quality of that habitat as continuing use along the West Fork has done to date. With the expansion of housing at Greer, additional recreational pressures on the area are likely to continue.
- The two of the three robust jumping mouse populations not affected by the proposed action may also not be at significant risk from recreation, however, the upper San Francisco River population is near to the town of Alpine and may be affected by continued growth in that area. The Wallow Fire burned near this area, and it is unknown

if past fuels reductions in the area that kept the fire from burning Alpine also protected the jumping mouse habitat. The Campbell Blue Creek population is more remote, and likely has fewer recreation pressures but was also affected by the Wallow Fire. The Three Forks site does not have recreational use due to the closure, however, may have some effects from the Wallow Fire that could affect habitat and population size. The current degraded habitat conditions at formerly occupied habitats affected by the stocking actions does not result in additional adverse effects to the jumping mouse since these areas no longer support suitable habitat and are not occupied, thus continuing the proposed action would not reduce the baseline viability of the Arizona portion of the range although restoration of these degraded habitats to improve species status is unlikely to occur.

- Conservation measures for protection of jumping mouse habitat on AGFD owned lands in the Black River will provide conservation benefits to the species over the long term.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The prohibitions against taking New Mexico meadow jumping mouse found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for this species at this time. The proposed action, through the Conservation and Mitigation Program, is providing conservation measures directed to address potential take that may result from the proposed action. If and when the jumping mouse is proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement at that time.

### Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

### CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

As part of the CAMP, AGFD will explore opportunities to manage for suitable New Mexico meadow jumping mouse habitat on other AGFD-owned properties in the White Mountains.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### Northern Mexican Gartersnake (*Thamnophis eques megalops*)

#### DESCRIPTION OF THE PROPOSED ACTION

The northern Mexican gartersnake (NM gartersnake) is in the vicinity of sportfish stocking sites in the Black River, Granite Creek, Lower Verde River, Middle Verde River, Santa Cruz River, Schoen's, Tonto Creek, and White Mountain stocking complexes (Table 27). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. The degree of potential adverse effects to NM gartersnake from stocking sportfish in these areas varies and is described in the analyses for each complex.

Table 27: Stocking sites, sportfish species proposed for stocking, and potentially affected NM gartersnake populations.

| Stocking complex/<br>Sites | Species stocked           | NM gartersnake population |
|----------------------------|---------------------------|---------------------------|
| <i>Black River</i>         |                           |                           |
| Ackre Lake                 | ONAP, THAR                | Black River               |
| Big Lake                   | ONMY, SAFO,<br>ONCL, ONAP | Black River               |

|                                          |                                                        |                                     |
|------------------------------------------|--------------------------------------------------------|-------------------------------------|
| Crescent Lake                            | ONMY, SAFO                                             | Black River                         |
| East Fork Black River                    | ONAP, ONMY*                                            | Black River                         |
| West Fork Black River                    | ONAP                                                   | Black River                         |
| <i>Granite Creek</i>                     |                                                        |                                     |
| Goldwater Lake                           | ONMY, PONI,<br>LEMA, MISA                              | Middle Verde River                  |
| Watson Lake                              | ONMY*, PONI,<br>LEMA                                   | Middle Verde River                  |
| Willow Creek                             | ONMY*, PONI,<br>LEMA                                   | Middle Verde River                  |
| <i>Lower Verde River</i>                 |                                                        |                                     |
| East Verde River                         | ONMY                                                   | Middle Verde River                  |
| Green Valley Lake                        | ONMY                                                   | Middle Verde River                  |
| <i>Middle Verde River</i>                |                                                        |                                     |
| Deadhorse Ranch SP                       | ONMY, ICPU,<br>LEMA*, MISA*,<br>PONI*, DOPE*           | Middle Verde River                  |
| Middle Verde                             | ONMY                                                   | Middle Verde River                  |
| Oak Creek                                | ONMY                                                   | Oak Creek, Middle Verde River       |
| West Clear Creek                         | ONMY                                                   | Middle Verde River                  |
| Wet Beaver Creek                         | ONMY                                                   | Middle Verde River                  |
| <i>Santa Cruz River</i>                  |                                                        |                                     |
| Arivaca Lake                             | ICPU, LEMA,<br>LEMI                                    | Arivaca Cienega                     |
| Parker Canyon Lake                       | ONMY, ICPU,<br>LEMA*, LEMI*                            | Scotia Canyon, San Rafael<br>Valley |
| Patagonia Lake                           | ONMY                                                   | Sonoita Creek                       |
| <i>Schoen's Complex</i>                  |                                                        |                                     |
| Mountain Meadow<br>Recreational Complex* | ONMY, LEMA                                             | Lake o' the Woods                   |
| Rainbow Lake                             | ONMY, ICPU*,<br>LEMA*, MISA*                           | Lake o' the Woods                   |
| Scotts Reservoir                         | ONMY, ICPU,<br>LEMA, MISA                              | Lake o' the Woods                   |
| Show Low Creek*                          | ONMY                                                   | Lake o' the Woods                   |
| Show Low Lake                            | ONMY, SAFO*,<br>ONCL*, ONAP*,<br>ICPU, LEMA*,<br>MISA* | Lake o' the Woods                   |
| Woodland Lake                            | ONMY, ICPU,<br>LEMA*                                   | Lake o' the Woods                   |
| <i>Tonto Creek</i>                       |                                                        |                                     |
| Christopher Creek                        | ONMY                                                   | Tonto Creek                         |
| Haigler Creek                            | ONMY                                                   | Tonto Creek                         |
| Tonto Creek                              | ONMY                                                   | Tonto Creek                         |

|                       |      |                   |
|-----------------------|------|-------------------|
| <i>White Mountain</i> |      |                   |
| Little Mormon Lake    | ICPU | Lake o' the Woods |
| Long Lake             | ONMY | Lake o' the Woods |
| Sponseller Lake       | ONMY | Lake o' the Woods |
| Whipple Lake          | ICPU | Lake o' the Woods |

Conservation measures included in the proposed action

Northern Mexican gartersnake is a priority species for conservation in the proposed action and as such, will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

AGFD commits to provide for two NM gartersnake populations either through securing existing but threatened populations or establishment of new conservation populations. The first population will be initiated within five years and the second population within seven years.

In providing for two gartersnake populations either through securing existing but threatened populations or establishment of new conservation populations, a source for individuals to reestablish conservation populations is needed, as well as information on propagation, release options, and techniques for successfully securing existing threatened populations. Member organizations of the Gartersnake Conservation Working Group have initiated applied research in these arenas, and the AGFD shall contribute to these types of efforts during the 10-year program. Once sufficient information is obtained on techniques to reestablish populations and/or secure existing threatened populations, the AGFD shall initiate the population reestablishment and/or securing actions. Within two years the AGFD will develop a plan to support and/or implement research in these arenas. Supporting and/or implementing this research will then follow the plan.

Within three years, AGFD shall develop outreach material on gartersnakes to attempt to reduce the deliberate killing or injuring of gartersnakes by the public. Materials developed for this program will be posted at stocking sites that contain populations of gartersnakes.

As part of all native fish reintroduction efforts in Arizona, AGFD shall ensure that renovated streams occupied by NM gartersnakes will be quickly restocked with appropriate native fish species and native frog species that can provide prey for NM gartersnakes so as to not put stress on any NM gartersnake population through elimination of its forage base. This measure will be implemented as needed.

Within three years, AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the AGFC for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, AGFD shall review and update existing outreach programs on the risks to

native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

#### STATUS OF THE SPECIES (rangewide and/or recovery unit)

##### *Listing*

NM gartersnake was designated a candidate species for listing under the ESA in 2008 (USFWS 2008b).

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the NM gartersnake. This information was taken from the 12-month findings for 2006 (USFWS 2006c) and 2008 (USFWS 2008b). Information in these documents is incorporated by reference.

##### *Life history*

The northern Mexican gartersnake is surface active at ambient temperatures ranging from 71 degrees Fahrenheit (°F) to 91°F (22 degrees Celsius (°C) to 33 °C), generally March through October and forages along the banks of waterbodies. Rosen (1991) found that northern Mexican gartersnakes spent approximately 60 percent of their time moving, 13 percent of their time basking on vegetation, 18 percent of their time basking on the ground, and 9 percent of their time under surface cover; body temperatures ranged from 24-33°C (75-91°F) and averaged 28°C (82°F), which is lower than other, similar species with comparable habitat and prey preferences. Rosen (1991) suggested that lower preferred body temperatures exhibited by northern Mexican gartersnakes may be due to both (1) their tendency to occupy cienega-like habitat where warm ambient temperatures are relatively unavailable; and, (2) their tendency to remain in dense cover.

The northern Mexican gartersnake is an active predator and is believed to heavily depend upon a native prey base (Rosen and Schwalbe 1988). Northern Mexican gartersnakes forage generally along vegetated banklines, searching for prey in water and on land, using different strategies (Alfaro 2002). Generally, its diet consists predominantly of amphibians and fishes, such as adult and larval native leopard frogs (e.g., lowland leopard frog (*Rana yavapaiensis*) and Chiricahua leopard frog), as well as juvenile and adult native fish species (e.g., Gila topminnow, desert pupfish, Gila chub, and roundtail chub) (Rosen and Schwalbe 1988). Auxiliary prey items may also include young Woodhouse's toads, treefrogs (Family Hylidae), earthworms, deer mice (*Peromyscus spp.*), lizards of the genera *Aspidoscelis* and *Sceloporus*, larval tiger salamanders, and leeches (Gregory et al. 1980 Rosen and Schwalbe 1988; Holm and Lowe 1995; Degenhardt et al. 1996; Rossman et al. 1996; Manjarrez 1998). To a much lesser extent, this snake's diet may include nonnative species, including larval and juvenile bullfrogs, and mosquitofish (Holycross et al. 2006). Venegas-Barrera and Manjarrez (2001) reported the first observation of a snake in the natural diet of any species of *Thamnophis* after documenting the consumption by a

Mexican gartersnake of a Mexican alpine blotched gartersnake (*Thamnophis scalaris*).

Sexual maturity in northern Mexican gartersnakes occurs at two years of age in males and at two to three years of age in females (Rosen and Schwalbe 1988). Northern Mexican gartersnakes are ovoviviparous (eggs develop and hatch within the oviduct of the female). Mating occurs in April and May followed by the live birth of between 7 and 26 newborns (newly born individuals) (average is 13.6) in July and August (Rosen and Schwalbe 1988). Unlike other gartersnake species, which typically breed annually, approximately half of the sexually mature females within a population of northern Mexican gartersnake reproduce in any one season (Rosen and Schwalbe 1988). This may have negative implications for the species' ability to rebound in isolated populations facing threats such as nonnative species, habitat modification or destruction, and other perturbations. Low birth rates will impede recovery of such populations by accentuating the effects of these threats.

The life span of NM gartersnake in the wild is unknown; however, other similar species may live up to nine or ten years under suitable conditions. Survival past birth to reproductive age varies; the number of neonates that live to become adults was estimated for another gartersnake as 16 and 50 percent in two study groups. Adult survival is also variable, year-to-year survivorship in two populations of another gartersnake species was 34 and 67 percent. Based on demographic studies on the common gartersnake and making a conservative estimate on survivorship and fecundity rates without consideration of the presence or degree of threats, it is reasonable to presume that, on average, two individual northern Mexican gartersnakes from each litter may reach reproductive age. Whether or not these individuals find a mate and successfully reproduce depends upon the population density and the degree of threats that may be acting on a given population.

#### Habitat

Throughout its rangewide distribution, the northern Mexican gartersnake occurs at elevations from 130 to 8,497 feet (ft) (40 to 2,590 meters (m)) (Rossman et al. 1996). The northern Mexican gartersnake is a riparian obligate (restricted to riparian areas when not engaged in dispersal behavior) and occurs chiefly in the following general habitat types: (1) Source-area wetlands (e.g., cienegas (mid-elevation wetlands with highly organic, reducing (basic or alkaline) soils), stock tanks (small earthen impoundment), etc.); (2) large-river riparian woodlands and forests; and (3) streamside gallery forests (as defined by well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass) (Hendrickson and Minckley 1984; Rosen and Schwalbe 1988; AGFD 2001). Generally, it is believed that NM gartersnake spends most of its time within the boundaries of the 100-year floodplain along the streams or tanks where it forages. Recent information from telemetry studies indicates that NM gartersnake will move away from such areas to dry hillsides. The extent of overland movements between drainages is unknown; however, most semi-aquatic and aquatic amphibians and reptiles are known to move overland during wet seasons and at night when dispersing. Additional information on the habitat requirements of the northern Mexican gartersnake within the United States and Mexico can be found in Rosen and Schwalbe (1988), Rossman et al. (1996), McCranie and Wilson (1987), and Cirett-Galan (1996).

### Current distribution

Within Mexico, northern Mexican gartersnakes historically occurred within the Sierra Madre Occidental and the Mexican Plateau in the Mexican states of Sonora, Chihuahua, Durango, Coahila, Zacatecas, Guanajuato, Nayarit, Hidalgo, Jalisco, San Luis Potosí, Aguascalientes, Tlaxacala, Puebla, México, Veracruz, and Querétaro, comprising approximately 85 percent of the total rangewide distribution of the species (Conant 1963; Van Devender and Lowe 1977; McCranie and Wilson 1987; Rossman et al. 1996; Lemos-Espinal et al. 2004).

Determining the status of the northern Mexican gartersnake in Mexico is hampered by the lack of large-scale surveys, research, and other pertinent information for that country. We can determine that there have been important large-scale losses of northern Mexican gartersnake habitat, including surface waters such as rivers, streams, wetlands, and springs, that certainly have affected gartersnake populations. We can also determine that, where local surveys have been conducted; northern Mexican gartersnakes have been extirpated or are declining (Manjarrez 2008).

Within the 15 percent of the range contained in the United States, the northern Mexican gartersnake historically occurred predominantly in Arizona at elevations ranging from 130 to 6,150 ft (40 to 1,875 m). It was generally found where water was relatively permanent and supported suitable habitat. The northern Mexican gartersnake historically occurred in every county within Arizona, within several perennial or intermittent drainages and isolated wetlands. Historically, the northern Mexican gartersnake had a limited distribution in New Mexico that consisted of scattered locations throughout the Gila and San Francisco headwater drainages in Grant and western Hidalgo counties. There were also populations along the lower Colorado River in California and Nevada.

Currently, in the United States portion of the range, NM gartersnake persists in only in limited portions of Apache, Gila, Pima, Navajo, Santa Cruz and Yavapai counties, Arizona, and Grant County, New Mexico. Populations in California and Nevada are extirpated.

The perennial or intermittent stream reaches and isolated wetlands where we conclude northern Mexican gartersnakes remain in Arizona include: (1) the Santa Cruz River/Lower San Rafael Valley (headwaters downstream to the International Border); (2) the Verde River from the confluence with Fossil Creek upstream to Clarkdale; (3) Oak Creek at Page Springs; (4) Tonto Creek from the mouth of Houston Creek downstream to Roosevelt Lake; (5) Cienega Creek from the headwaters downstream to the “Narrows” just downstream of Apache Canyon; (6) Pantano Wash (Cienega Creek) from Pantano downstream to Vail; (7) Appleton–Whittell Research Ranch and vicinity near Elgin; and, (8) Red Rock Canyon east of Patagonia. The only “reliable” populations, those where NM gartersnake are likely to be found during surveys, are the Santa Cruz/San Rafael, Tonto Creek, and Oak Creek populations. Of those three populations, the Oak Creek and Santa Cruz/San Rafael are the most stable, with NM gartersnake of all age classes present. Based on current survey data, NM gartersnake at the other sites are at low densities and few are captured even with significant survey effort.

The perennial or intermittent stream reaches and isolated wetlands where the status of the



northern Mexican gartersnake remains uncertain include: (1) the downstream portion of the Black River drainage from the Paddy Creek confluence; (2) the downstream portion of the White River drainage from the confluence of the East and North forks; (3) Big Bonito Creek; (4) Lake O'Woods near Lakeside; (5) Spring Creek above the confluence with Oak Creek; (6) Bog Hole Wildlife Area; (7) Upper 13 Tank, Patagonia Mountain bajada; (8) Babocamari River; (9) Upper Scotia Canyon in the Huachuca Mountains; (10) Arivaca Cienega.

### Threats

The first 12-month finding (USFWS 2006c) detailed the threats to NM gartersnake including loss of habitats due to groundwater pumping, elimination of cienegas, water diversions, elimination of riparian areas due to improper watershed uses including improper livestock management, urban development including roads, and other factors. This discussion focuses on those threats of relevance to the evaluation of the proposed action.

The introduction of nonnative invertebrates, amphibians, and fishes to Arizona has significant effects to NM gartersnake in the form of predation and competition (particularly predation on neonates and juveniles by centrarchid fish, catfish, and bullfrogs) that affects recruitment, and, perhaps more significantly, alterations to their prey base from nonnative species preying on and competing with native fish and frogs. NM gartersnake are predators with native frogs forming a major portion of their diet with small, soft-bodied native fish also important. Distribution and population size of both these groups has significantly been altered by the introduction of the nonnative species, to the extent that they are no longer widespread across watersheds. Predation, competition, and disease and parasite introductions are factors in the decline of the native fauna. Remnant populations of the Chiricahua leopard frog, Gila topminnow, desert pupfish, Gila chub, and other non-listed species such as longfin or speckled dace that once supported NM gartersnake are scattered across the landscape. Nonnative species occupy much of the remaining aquatic habitats and are of lesser value to NM gartersnake as prey items. For example, spiny-rayed fishes such as the centrarchids are difficult to ingest without injury due to the dorsal spines. The 2006 12-month finding goes into considerable detail on the effects of nonnative species on the prey base on NM gartersnake. Without a robust prey base, neonate and juvenile NM gartersnake may not be able to find sufficient food to support growth, and adult NM gartersnake may produce fewer and less viable young due to poor health. As noted earlier, female NM gartersnake do not breed every year, and a reduction in viable neonates because of her health is an issue for survival of the young.

### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of conservation actions for the NM gartersnake.

Ongoing conservation actions for NM gartersnake are undertaken by the Gartersnake Conservation Working Group (GCWG) include monitoring, telemetry studies, captive propagation projects and conservation planning for future reintroductions (GCWG 2008). NM gartersnake is also included as a covered species in the draft San Rafael Cattle Company Habitat Conservation Plan and the final Horseshoe-Bartlett HCP (SRP 2008). There is ongoing

conservation work in the form of monitoring for NM gartersnake at Bubbling Ponds and Page Springs State Fish Hatcheries.

#### *Previous consultations*

NM gartersnake is a recent (2008) candidate species and a record of section 7 consultations evaluating the effects of actions on the species does not currently exist.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

#### **Description of the Action Area**

NM gartersnake are potentially affected by sportfish stocking actions in several disjunct drainages. The different drainages will be discussed individually below. Drainages where effects to NM gartersnake are more limited will be discussed first.

#### Stocking locations with limited effects to NM gartersnake or prey base

##### *Black River Complex*

Four of the five Black River complex sites are located in the headwater area of the Black River, with the fifth located below the confluence of the East and West Forks that creates the Black River proper. This area is historical habitat for NM gartersnake, currently; the closest population extends up to at least the confluence with Paddy Creek, at least 20 miles below the Fish Creek (site of the Ackre Lake stocking site) confluence. The status of this NM gartersnake population is unknown. It is unlikely that a significant number of stocked trout from the upper four headwater sites would move downstream in the Black River to NM gartersnake habitat. Apache trout stocked into Ackre Lake in the head of the Fish Creek drainage can move out of the lake and into the creek, which also supports a recovery population of Apache trout. Movement of Apache trout from the Fish Creek recovery population into the Black River and then downstream into the NM gartersnake area is possible. Whether those fish included stocked Apache trout is not possible to say, since all the Apache trout in Fish Creek are from stockings.

The prey base in the Black River has been heavily impacted by nonnatives species, particularly brown trout and smallmouth bass. Native leopard frogs are largely eliminated from the upper Black River except in reintroduction sites in the headwaters. While there are effects from stocked sportfish to those reintroduced populations if Chiricahua leopard frogs disperse from the secure sites into the stocking reaches, the presence of other nonnative predators significantly contributes to the failure of dispersal efforts into these reaches. The native fish community in the

mainstem Black River and its tributaries near NM gartersnake habitats are more likely supporting the NM gartersnake population. Effects to that population from the stocked trout is limited by the distance the stocked fish need to travel, the mortality rate of these trout such that few survive to move out of the stocking reach that leads to few fish accessing the NM gartersnake habitat. Further, rainbow and Apache trout are not likely to persist in the warmer waters downstream, unlike the brown trout and smallmouth bass that dominate the nonnative fish fauna there.

While the Wallow Fire may have had some effects to the NM gartersnake populations in the Black River through impacts to its prey base, the magnitude of those effects is unknown. However, for the proposed action, due to the above factors, effects to NM gartersnake from stocking in the Black River watershed are limited.

#### *East Verde River Complex*

The East Verde River complex contains two stocking sites, one in the headwaters and one a man-made lake in the Town of Payson. NM gartersnake are found in the mainstem Verde River as far as the confluence with Fossil Creek, which is a few miles upstream of the East Verde River confluence. The Middle Verde population of NM gartersnake is of low density, and precise delineation of the end of occupied habitat is difficult and likely varies. Rainbow trout are stocked into the headwaters area during the summer and are unlikely to move downstream during this period in numbers that could affect NM gartersnake or their prey base due to the existing nonnative community. Rainbow trout would not persist in the lower East Verde or the Verde mainstem due to high summer temperatures.

#### *Granite Creek Complex*

The Granite Creek Complex is in the headwaters of the Verde River. NM gartersnake are believed extirpated from this reach of the Verde River, but are considered to occupy the river immediately downstream of this reach. Three stocking sites, Goldwater Lake, Watson Lake, and Willow Creek Lake have the potential to spill into the upper Verde River. Stocked fish species most likely to access the river are rainbow trout, bluegill and black crappie, with a much lesser risk of stocked largemouth bass due to the distance and connectivity between Goldwater Lake and Watson Lake. Wild largemouth bass are in Watson Lake and may access the river but these are not stocked fish. Spills from Watson or Willow Creek lakes are not uncommon, and there is connectivity to the upper Verde via Granite Creek. There is one record for bluegill in 1992, and none for black crappie or rainbow trout in the upper Verde. Since most surveys of the upper Verde are made in the summer, it would be unlikely to detect rainbow trout that escaped the lakes during any spring spill events due to the high summer temperatures in the river that are outside of rainbow trout tolerances.

Northern Mexican gartersnake prey species may be affected. Rainbow trout are identified as a predator on native frogs (Matthews et al. 2002) and also on small fish and bluegill can be significant predators on tadpoles of native frogs (USFWS 2007b) but they are less significant predators on very small fish. Black crappie is also an important predator on small fish, and has a varied diet that could include tadpoles if they were available. Chiricahua and northern leopard

frogs are no longer present in the upper Verde River; however, lowland leopard frogs may be present in the drainage. Tadpoles of lowland leopard frogs may be available when stocked sportfish species are present.

The magnitude of potential effects from rainbow trout, bluegill or black crappie accessing the upper Verde River on the prey base of NM gartersnake should consider the relative infrequency of spill events occurring, the likelihood that few individuals of the stocked species would be transported out of the lakes, and the distance these fish would have to be transported to be in NM gartersnake habitats in the vicinity of Clarkdale. Further, the nonnative fish population within occupied NM gartersnake habitat is already robust, and likely has had and will continue to have significant impacts to NM gartersnake and its prey base in the absence of any input of stocked fish species from the Granite Creek stocking sites. The additive effect of the occasional rainbow trout, bluegill, or black crappie is not significant.

### *Schoen's Complex*

Schoen's Complex stocking sites are in the upper portion of the Show Low Creek drainage. Lake o' the Woods is in this drainage; located on Walnut Creek it receives flow from Rainbow Lake upstream, which also drains from Woodland Lake. Woodland and Rainbow lakes support self-sustaining largemouth bass and bluegill populations, with some channel catfish recruitment, although supplemental stocking of channel catfish is done periodically. Largemouth bass and bluegill would only be stocked in the event of a need to restore the fishery; the long-term goal is to retain these warmwater species in the drainage. Rainbow trout are proposed for annual stocking. There are very few native fish left in this portion of the drainage, with only a few speckled dace and one reintroduced bluehead sucker population extant. There are no extant leopard frog populations, and streams also contain green sunfish, bullfrogs, and fathead minnows.

The status of NM gartersnake in the upper Show Low Creek drainage is unknown. The historical records date from 1942 and 1949, with no reports since then. NM gartersnake may persist to the south on the White Mountain Apache Reservation, but these reports are unverified. The potential for NM gartersnake to be in the vicinity of the Schoen's complex stocking sites is very low, based on the lack of recent records, the number of potential predators, and the unsuitable prey base.

Due to the above factors, effects to NM gartersnake from stocking in Schoen's complex watershed are limited.

### *Tonto Creek Complex*

Tonto Creek complex contains three stocking sites in the headwaters of the drainage. NM gartersnake populations are located approximately 20 miles below these sites, from Houston Creek to Roosevelt Lake. This is a low density population, with adults and neonates present but few intermediate sizes. Few stocked rainbow trout overwinter in the upper drainage to be displaced downstream during spring runoff; however, monsoon flood events occur during the stocking period and may displace rainbow trout downstream toward NM gartersnake habitat. In

all surveys conducted below Hells Gate, only one rainbow trout was captured; near Gisela which is about a mile below Houston Creek's confluence with Tonto Creek. The time of year for that record is unknown. Water temperatures below Hells Gate in June may be warm enough to preclude rainbow trout survival. If this is correct, then temperatures further downstream where NM gartersnake are present are already beyond the tolerance of rainbow trout and any individuals displaced in July through September would be unlikely to persist more than a few days. Rainbow trout displaced downstream could persist for several months in the spring to early summer and overlap with NM gartersnake during that time.

The displaced rainbow trout are small (10 inches) and are unlikely to be able to prey on any life stage of NM gartersnake. They may also be too large to be preyed on by NM gartersnake, but this may occur. Warmwater nonnative fish, including green sunfish, largemouth bass, smallmouth bass, and yellow bullhead as well as bullfrogs and crayfish dominate the lower reaches of Tonto Creek where NM gartersnake is extant. Lowland leopard frogs are found in several tanks and perennial waters in the lower Tonto Creek drainage, and they may access the creek during dispersal after precipitation events. There is a risk of predation on very small lowland leopard frogs from rainbow trout; however, any lowland leopard frog that does access Tonto Creek is much more likely to be preyed on by the nonnative warmwater predators. The potential effects to NM gartersnake in lower Tonto Creek from stocking in the headwaters are very limited.

#### *White Mountain Complex*

The White Mountain Complex is in the Little Colorado River drainage. NM gartersnake are believed to be extirpated from most of this drainage except from the area around the headwaters of Show Low Creek near Lake O' the Woods. The White Mountain complex is hydrologically connected to Show Low Creek at the extreme lower end where Show Low Creek joins Silver Creek. The nearest stocking sites in White Mountain are Long, Whipple, and Little Mormon Lake, which are on the other side of the divide between the two drainages but within a mile of Show Low Creek. Sponseller Lake is more than 15 miles to the east, and unlikely to have effects to NM gartersnake.

Sportfish species (rainbow trout and channel catfish) stocked into Long, Whipple, and Little Mormon lakes are unlikely to leave those systems in a way that allows them to access Show Low Creek. Any NM gartersnake in the area around Lake O' the Woods can move downstream in the Show Low Creek drainage and cross the divide to Long Lake. Except in wet years, Long Lake is dry, with perhaps some damp areas. There are no fish or frogs persisting in Long Lake. Whipple and Little Mormon Lake are two to three miles further east. Whipple Lake only has water if it spills from Little Mormon Lake, and spills have not occurred since the early 1990s. Little Mormon Lake has water more often, but even when it does, there may not be enough to stock channel catfish.

The distance from the known NM gartersnake site at Lake O' the Woods, the lack of recent records of NM gartersnake in the vicinity, the intermittent stocking actions likely over the next 10-years and the lack of a prey base at these sites combine to indicate effects to NM gartersnake from stocking these sites are limited.

Stocking locations with effects to NM gartersnake or prey base*Middle Verde River Complex***Description of the action area**

The Middle Verde River complex contains five stocking sites where stocked warmwater fish and rainbow trout are stocked into or adjacent to occupied NM gartersnake habitat and individual NM gartersnake and their prey base could be affected by the stocking. The closed system at Deadhorse Ranch State Park is unlikely to affect the prey base of NM gartersnake since fish cannot on their own escape from the stocking sites. The action area for this complex is the mainstem Verde River from the Tapco Diversion down to the confluence with Fossil Creek including the perennial drainages of Oak, West Clear, and Wet Beaver to the upstream ends of the stocking sites and the ponds at Dead Horse Ranch State Park.

**A. Status of the species within the action area**

NM gartersnake is found in low densities along the mainstem Verde River from Clarkdale to the confluence with Fossil Creek. Individuals may be present in any watered area along this reach; however, the number of individuals at any one location is unknown. There are no records for West Clear Creek or Wet Beaver Creek; however, these waters connect to the Verde River and may be occupied at levels similar to that in the mainstem. The largest population of NM gartersnake in Arizona is at the Bubbling Ponds and Page Springs State Fish Hatcheries on Oak Creek. This population is one of two in Arizona that retains sufficient density to be a viable breeding population.

**B. Factors affecting the species' environment within the action area**

The status of NM gartersnake in the Verde River action area is a result of a variety of threat factors, but particularly the expansion of nonnative invertebrates, amphibians, and fish both in terms of the number of such species and the expansion of them across the watershed. The lowland leopard frog, a component of the NM gartersnake prey base, persists in the middle Verde River drainage. Specific locations of lowland leopard frog populations are poorly known and declines have been observed, but the central Arizona occupied area is considered relatively secure (Sredl 1997) and continues to provide foraging opportunities for NM gartersnake where the two species are in contact. The native fish portion, primarily in the form of suckers and roundtail chub is extant, but is at differing densities in various locations across the area, and the robustness and extent of recruitment (NM gartersnake can only prey on small individuals) is uncertain. Other potential native fish prey species still present are Gila chub (in Spring Creek, a tributary to Oak Creek) and in Red Tank Draw and Walker Creek, tributaries to Wet Beaver Creek), and longfin dace. Potential nonnative prey species include red shiner, mosquitofish, and small bullfrogs. The current fish fauna of the action area is largely dominated by centrarchids (smallmouth bass, largemouth bass, green sunfish), ictalurids (channel catfish, flathead catfish, and yellow bullhead), and red shiner. All the species above are predators or competitors on the native fishes and frogs that are the natural prey base for NM gartersnake.

Portions of the action area are subject to significant water diversions that affect the amount and quality of aquatic habitats that may also have effects on the native and nonnative aquatic species populations. Particularly through the Verde Valley (Clarkdale to Camp Verde), summer flows become low and water quality suffers as natural flows are diverted for agricultural and other purposes. Because Verde River flows in the action area are not controlled by upstream water storage, and in the natural hydrograph, summer flows tend to be low; these diversions have a considerable affect on the aquatic communities in the reach. Low flows concentrate aquatic species in remaining pool habitats when runs and riffles become too shallow for fish, and this can lead to increased competition for scarce resources, and direct predation events. Water quality may not be suitable and result in death of individuals of species not as able to tolerate poor conditions. Diversions on the Verde River tributaries in this reach reduce those inflows, and reduce habitat quality below the diversions there. Below Camp Verde, other inflows restore base flow in the river, but it is still less than it would have been historically.

The current status of NM gartersnake in the action area is the result of past human activities as summarized above and more fully described in the 2006 and 2008 12-month findings (USFWS 2006c, 2008b) and the 2010 Candidate Notice of Review (USFWS 2010g). Drought may also be a factor in recent status, as it has affected flows which impact both the prey base and individual NM gartersnake.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish, amphibian, and reptile species. Additional discussions on the effects of nonnative stocked sportfish species to the NM gartersnake are in the 12-month findings (USFWS 2006c, 2008b). These documents are incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on NM gartersnake or its prey base.

Rainbow trout are the only sportfish species included for the program in the action area with additional warmwater species proposed for Deadhorse Lake. Fish stocked into Deadhorse Lake are in a closed system and unless NM gartersnakes move to the lake to forage, would not come into contact with these species.

In the middle Verde River, 30,000 would be stocked annually between November and March; in Oak Creek, 60,000 would be stocked annually from March to November, and 6,000 each would be stocked into West Clear and Wet Beaver creeks in March to May and October to November.

Usually, the mainstem Verde River becomes too warm to sustain rainbow trout over the summer; however, stocked rainbow trout have been found as late as August (Bonar et al. 2004). The lower part of Oak Creek below the stocking site becomes unsuitable for trout persistence, as does West Clear and Wet Beaver, during the summer. Because rainbow trout do not breed in the mainstem Verde River (although they do in upper portions of Oak Creek and above the West Clear Creek stocking reach), rainbow trout found in the action area are assumed to be stocked fish.

Rainbow trout are implicated in the decline of native frogs in high mountain lakes in California (Matthews et al. 2002). Natural populations of Chiricahua leopard frogs are extirpated from the Verde River and northern leopard frogs are rare. Lowland leopard frogs occupy suitable habitats in the Verde River drainage (Sredl 1997) and since they breed from January to May (AGFD 2006), tadpoles may be available to stocked rainbow trout if there are frogs in habitats connected to the stocking sites. As the specific distribution of lowland leopard frogs across the Verde River watershed is unclear, the extent of potential overlap between lowland leopard frog tadpoles and rainbow trout is unknown. The extant populations of nonnative warmwater fish (particularly largemouth bass, smallmouth bass, and green sunfish), bullfrogs, and crayfish in the Verde River exert a significant predation pressure on the resident lowland leopard frog populations that is increased by the presence of rainbow trout during the period when tadpoles are present. The long term status of the lowland leopard frog in the vicinity of the stocking sites is unknown.

As described in the BA chapter on sportfish-native fish interactions, rainbow trout are variably piscivorous, with the level of piscivory dependent on a number of factors. Hatchery-reared rainbow trout are also variable in the speed at which they convert to foraging for wild prey once stocked into a location. The length of time a stocked rainbow trout is at large in the system is a factor in whether it does or does not convert to a wild diet. Further, when stocked in larger numbers than an immediate habitat area can support, and when the available habitat already contains populations of territorial or aggressive nonnative species, the hatchery rainbow trout is at a disadvantage in selecting prime habitats and foraging locations in the vicinity of the stocking site. These hatchery rainbow trout may then be found in areas of the waters where, under “normal” circumstances, they might not select. These areas may also bring them into contact with small native fish larvae or juveniles, allowing opportunity for predation. Propst et al. (1998) documented stocked rainbow trout preying on loach minnow in the Gila River. Bonar et al. (2004) discussed the relative piscivory of nonnative fishes in the Verde River. Part of their study area was in the action area, and they were able to make some observations about the piscivory of the stocked rainbow trout. Bonar et al. (2004) in the Verde River observed that the stocked rainbow trout were primarily insectivores; however, they did consume small fish (only nonnative fish were documented), and, in their study, rainbow trout had the second highest consumption rate of fish (after largemouth bass). Bonar did identify a concern that if present in large numbers, stocked rainbow trout could have an effect on native fish recruitment through predation, particularly if their presence came during the spawning period for the native fish species. However, the authors did note the limitations of the study (only 32 rainbow trout were captured) and recommended additional research be conducted on this topic prior to modifying stocking practices.

While native suckers were not identified specifically in the literature as potential prey species for



NM gartersnake, it is likely they were used in the larger rivers where NM gartersnake once lived, as they would have formed a considerable portion of the fish community. Bryan et al. (2002) observed that native Sonora and desert suckers in the lower Verde River (below Bartlett Dam, outside of the action area) began spawning in mid-February through July, and that water temperatures were a cue to spawning. As temperatures increased from the bottom of their study reach towards the top, spawning moved upstream with that temperature gradient. Roundtail chub, which are an important prey species for NM gartersnake, began to spawn in the reach in April. Spawning temperatures in the action area are suitable for both suckers and roundtail chub to breed during the period when stocked rainbow trout are present in the river and its tributaries. These small larval or young of the year native fish are found in low flow areas, including pools, backwaters, runs, generally in shallow waters with variable cover (Bryan et al. 2002). These are areas where rainbow trout, among other potential predators, are also found.

As indicated by Bonar et al. (2004), rainbow trout are not the only potential predator of native fish in the Verde River. Largemouth bass is the most significant predator, with the other warmwater species including channel catfish, flathead catfish, smallmouth bass, and yellow bullhead also regularly consuming fish. Native fish consumption in the spring and summer was high for these species, likely due to the availability of small native fish after the spawning period. Bonar et al. (2004) suggests that the extant nonnative fish community, including rainbow trout, could be negatively impacting recruitment of native fishes. The most robust populations of native fish in the Verde River are below Bartlett Dam, outside of occupied NM gartersnake habitat. Populations of these species within occupied NM gartersnake habitat are not as robust, which may be a result of continuing high levels of predation by nonnative species. In addition to nonnative fish, crayfish and bullfrogs are also present in the system and have adverse effects on NM gartersnake, particularly neonates and juveniles.

The loss of the natural prey base has several effects on gartersnakes. Most importantly, the reduction in available prey increases foraging time, which has an energy cost and may make the individual more at risk of predation. Changes to the forage base also affect growth and health, as a diverse forage base with both larger and smaller prey items provides more opportunities to capture prey and to capture larger prey which is more energy efficient (Rosen et al. 2001). Mixed diets of fish and amphibians provided the best foraging opportunities, and gartersnakes that are presented with a diverse prey base learn to hunt many species, which is a benefit if one or another of the prey species declines (Krause and Burghardt 2001). A fish-only diet may also not be as energetically viable as one with amphibians included (Rosen et al. 2001). Reduced recruitment and increased over-wintering mortality result in part from poor nourishment during the active season. Attempts to prey on spiny-rayed nonnative fish may result in injury or death due to choking or injury from spines (Nowak and Santana-Bendix 2002, USFWS 2008b).

Historically, NM gartersnake occupied Oak Creek at least as far upstream as Manzanita Campground, but it does not permanently support a population at this time except through NM gartersnake that leave the hatchery sites. Lower Oak Creek in this vicinity is dominated by warmwater fish species with limited persistence of rainbow trout due to high water temperatures in the summer. The area is stocked with rainbow trout at least part of the season.

NM gartersnake are also reported from Dead Horse Ranch State Park. Ponds there contain

stocked warmwater sportfish which makes the area unsuitable for a stable NM gartersnake population. Individuals may wander onto the park from the adjacent Verde River. However, there is limited foraging opportunity at the park ponds, and NM gartersnake are unlikely to remain in the area for any significant period.

An important indirect effect for NM gartersnake is the deliberate killing of snakes by humans (USFWS 2006c). Anglers pursuing stocked sportfish at Dead Horse Ranch State Park and along Oak Creek may come into contact with individual NM gartersnake at these sites. There is less risk of angler-related mortality of NM gartersnake along the middle Verde stocking site because rainbow trout are stocked between November and March and NM gartersnake are active March through October. There is thus a limited time period in November and in March through May when anglers pursuing stocked rainbow trout may encounter NM gartersnake. This is of particular concern along Oak Creek due to the presence of the robust population of NM gartersnake at the Bubbling Ponds and Page Springs hatcheries that also uses areas along Oak Creek itself to forage. The amount of this mortality is unknown; however, rainbow trout are stocked in Oak Creek from March through November, so anglers are pursuing rainbow trout during the entire season that NM gartersnake is active. If this mortality is to dispersing NM gartersnake that are moving from the hatchery sites, then there is little effect to the population at the hatchery even though this mortality is occurring. However, such mortality may prevent establishment or recovery of the species along the adjacent reach of Oak Creek.

#### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Verde River stocking sites are on a mix of Coconino National Forest Service lands, state, and private lands. Land management actions including management of recreation, livestock use, forestry practices, and watershed management on the Coconino National Forest are subject to additional section 7 consultation. Activities on the state and private lands are not, and, particularly, management of water use and diversions is in private control. Water availability through the Verde Valley may be having effects to native fish populations there, and that may influence the NM gartersnake population in that reach. Low water levels may also make NM gartersnake neonates or juveniles more susceptible to predation by nonnative species that also has adverse effects to the population. There are various efforts ongoing in the Verde Valley to address future water use and we anticipate that these efforts will continue over the next 10-year period.

Also of concern are effects due to hatchery operations, construction, and maintenance at Bubbling Ponds and Page Springs. Accidental mortality of NM gartersnake from operations may occur at the two state fish hatcheries. Although deliberate killing of NM gartersnake is highly unlikely, use of vehicles or other equipment on the hatchery grounds may accidentally run over a NM gartersnake. Effects to habitat may also occur. The AGFD provided its hatchery staff with a list of best management practices to avoid or minimize effects to NM gartersnakes at the

hatcheries (Gurtin 2010)

AGFD is planning a major renovation at Bubbling Ponds SFH that will eliminate most of the existing NM gartersnake habitat on the site. However, as a separate action, AGFD is planning to create wetland habitat near the site that would support NM gartersnake, native frogs, and small native fish species. This new habitat for NM gartersnake may also serve as head-starting and grow-out opportunities for snakes that will be released into wild habitats. Ongoing monitoring at the hatchery is part of pre-project planning to assist in understanding the NM gartersnake populations on the site and contribute to habitat design. AGFD may opt to obtain a section 10(a)(1)(B) permit through a Habitat Conservation Plan for the renovation, which would then create a Federal nexus. Funding for the hatchery renovation may also include some Federal funds, although this is not currently documented. If Federal funds were involved, section 7 would not be required because NM gartersnake is not a listed species. Conference under the Act might be required if the funds were from USFWS or National Park Service sources.

Use of live baitfish (fathead minnow, threadfin shad, red shiner, mosquitofish, sunfish, and carp) is legal in the Verde River below Tuzigoot Bridge, which is in the action area. According to AGFD Fishing Regulations (AGFD 2009), live baitfish cannot be transported to the Verde River above Horseshoe Dam but they can be collected on-site for use. Nonnative tiger salamanders (waterdogs) are legal to buy, capture, transport, and use in the Verde River. Live bait species are not used to fish for stocked rainbow trout, but can be used for warmwater fish such as largemouth bass and smallmouth bass. It is also illegal to release any live bait species into any Arizona waters; however, there is angler release of these species. Baitfish species captured on site in the Verde River are not likely to contribute to the spread of new diseases or parasites since they are already exposed to those in the watershed. Tiger salamanders brought from other locations may be a vector for novel diseases or parasites, especially if taken from the wild at another location out of the immediate watershed. Tiger salamanders can act as vectors for diseases that affect other amphibian species, which then can put additional stress on lowland leopard frog populations in the Verde River, and therefore adversely affect NM gartersnake. A complete discussion of the spread of disease vectors and effects to native amphibians is contained in the area-wide section of this BCO.

### *Santa Cruz River Complex*

#### **Description of the action area**

Santa Cruz River complex contains one stocking site where NM gartersnake is known to be in proximity to the site (Parker Canyon Lake), one site with no recent records (Patagonia Lake), and one site where the status is unknown (Arivaca Lake). The action area is defined as the Santa Cruz River drainages containing these stocking sites.

#### **A. Status of the species within the action area**

NM gartersnake are found in the vicinity of Scotia Canyon, east of Parker Canyon Lake in low densities and may no longer be a stable population but the population is extant. This area was not affected by the 2011 Monument Fire which burned more of the eastern slopes of the

Huachuca Mountains. Recent efforts to eliminate bullfrogs from this drainage to enhance Chiricahua leopard frog and Arizona treefrog populations may assist in reviving this population. Releases of head-started Chiricahua leopard frogs into Scotia Canyon that have already occurred are likely to encourage a rebound in the NM gartersnake population in that area. The NM gartersnake population in the Santa Cruz/San Rafael Valley is upstream of the confluence of Parker Canyon with the Santa Cruz River and is considered a stable population. The historical sites near the Sonoita Creek State Natural Area in the vicinity of Patagonia Lake were re-surveyed in 2006 with no NM gartersnake found. NM gartersnake are still present in the vicinity of Red Rock Canyon, east of Patagonia, approximately six miles upstream of Patagonia Lake, but the robustness of the population is not defined (USFWS 2008b). The status of the Arivaca Cienega population is unknown. The Las Cienegas National Conservation Area population has declined significantly and may no longer be viable but is still extant. NM gartersnake are also found in Pantano Wash between Pantano and Vail, which is below its confluence with Cienega Creek.

## **B. Factors affecting the species' environment within the action area**

Loss of aquatic habitats from groundwater pumping, draining of cienegas, alteration of watersheds that changes flow patterns into the drainages, improper land use, recreational developments and the introduction of nonnative species have contributed to the status of NM gartersnake in the action area. The introduction of nonnative species has affected NM gartersnake directly through predation on young gartersnakes, and through changes to the native frog, salamander, and fish prey base. Ongoing drought is also a factor in the current availability of aquatic habitats. Formerly robust populations have declined significantly, with small, low density populations perhaps unable to sustain their numbers over the long term.

Conservation actions in the action area include extensive surveys to document the status of NM gartersnake, restoration efforts in Scotia Canyon for the prey base that can contribute to recovery of that NM gartersnake population, and management actions in the San Rafael Valley, including those under the proposed San Rafael Ranch HCP to maintain native fish and amphibian populations may provide conservation benefit to these populations.

## **EFFECTS OF THE ACTION**

Direct effects the NM gartersnake from sportfish stocking in the four proposed sites are limited at the present time since there are no NM gartersnake currently documented at the stocking sites. However, this consultation covers 10 years, and exposure of NM gartersnake to adverse effects of sportfish stocking at one or more of these sites may increase during that period. If NM gartersnake does begin to occupy areas around the stocking sites and use them for foraging by adults, there is a heightened risk of deliberate mortality of NM gartersnake by anglers.

Expansion of the NM gartersnake population in Scotia Canyon to move into historical habitats around Parker Canyon Lake can be anticipated. The lake is dominated by illegally stocked species (largemouth bass, bluegill, redear sunfish, green sunfish), with channel catfish legally stocked. Rainbow trout are stocked annually in the winter and some may carry over through the summer but do not spawn due to the lack of spawning habitat. The channel catfish also do not

recruit (or do so at a very low level) and are stocked as catchables or sub-catchables for a put-and-take fishery. The other warmwater species are self sustaining. Any NM gartersnake adult that accesses Parker Canyon Lake is unlikely to find any native frogs present due to the predaceous warmwater fish present; however, bullfrog tadpoles and small fish are available prey items for adult NM gartersnake.

Any NM gartersnake, particularly smaller sizes would be at risk of injury or death from predation attempts on them by largemouth bass, northern pike, or channel catfish. Establishment of a reproducing NM gartersnake population at the lake is highly unlikely but occasional use by adults for foraging may be expected. Similarly, the perennial water below the dam maintains a robust nonnative fish population with abundant bullfrogs. Adult NM gartersnake may opportunistically use this area but would not develop a reproducing population at the site. NM gartersnake adults could use areas away from the lake and perennial pool below the dam for reproduction and use the lake and downstream area for foraging.

Effects to the NM gartersnake population in the Santa Cruz River in the San Rafael Valley from fish escaping from Parker Canyon Lake after spill events are not anticipated. It is unlikely that any escaped fish would be able to access the occupied habitats, which are upstream of the confluence of the Santa Cruz and Parker Canyon. Any NM gartersnake using the confluence area may contact a nonnative fish there post-spill; however nonnative fish would not persist at the site due to its ephemeral nature.

The area around Patagonia Lake may also become occupied, particularly if Red Rock Canyon is renovated for native fish and frogs in coming years. Rainbow trout are unlikely to move out of Patagonia Lake; only one rainbow trout has been documented above the lake and none below. Rainbow trout do not persist over the summer in Patagonia Lake, so their opportunity to be exposed to NM gartersnake is limited. There are no native frogs in Patagonia Lake; however, there are small fish and bullfrogs that could be prey for adult NM gartersnake. As with Parker Canyon Lake, the extant warmwater fish community in the lake and the perennial reach below the lake largely precludes any permanent NM gartersnake occupancy of these areas, and the continuing stocking of rainbow trout is unlikely to have any additional adverse effects to NM gartersnake or their native prey base.

Arivaca Cienega is hydrologically connected to Arivaca Lake when the latter spills in spring or after heavy monsoon rains. The extent of NM gartersnake populations at the Cienega or at the Lake is unknown, and the population is likely present at low densities. Arivaca Lake itself is unlikely to be able to support NM gartersnake due to the warmwater fish community and bullfrogs present but adult NM gartersnake may forage opportunistically. Although largemouth bass are no longer proposed for stocking at the site, the extant population is self sustaining and unless a catastrophic die-off occurs that eliminates all individuals from the lake, is anticipated to remain present. There is a potential for stocked sportfish or their progeny to escape from the lake when it spills, although physical conditions in the path of the flow may limit the number or size of fish surviving to make it to the Cienega. Arivaca Cienega is a complex habitat that is difficult to survey, and there is potential for nonnative fish to persist for an unknown time. It is unlikely that bluegill or redear sunfish would be predators on NM gartersnake, but bluegill may prey on native frog tadpoles. The presence of these nonnative fish may influence habitat use by

NM gartersnake, particularly smaller individuals. Channel catfish, depending on size, can prey on neonate or juvenile NM gartersnake, but it is uncertain how much habitat for large catfish exists in the Cienega that would allow persistence. Any small NM gartersnake that accesses Arivaca Lake is likely to be preyed on by largemouth bass, stocked channel catfish, or bullfrogs.

## CUMULATIVE EFFECTS

The Arivaca Lake and Parker Canyon Lake stocking sites are on the Coronado National Forest. Land management actions including management of recreation, livestock use, forestry practices, and watershed management on the Coronado National Forest are subject to additional section 7 consultation. Patagonia Lake is on state lands, and management activities there are generally not subject to section 7 consultation. We are unaware of any upcoming non-federal actions at Patagonia Lake that would increase the existing threats or create new threats to NM gartersnake in the vicinity.

Use of live baitfish is prohibited in the Santa Cruz River drainage except the use of threadfin shad at Patagonia Lake. Use of tiger salamanders is legal at Arivaca Lake and Patagonia Lake and illegal at Parker Canyon Lake. The AGFD fishing regulations are unclear on how threadfin shad may be acquired for use at Patagonia Lake; however, based on other restrictions on transport of live baitfish, it is likely that they are only to be collected at the site. Waterdogs may be bought, captured, transported and used in the three lakes mentioned above. Live bait species are not used to fish for stocked rainbow trout, but can be used for warmwater fish such as largemouth bass. It is also illegal to release any live bait species into any Arizona waters; however, there is angler release of these species. Threadfin shad captured on site in Patagonia Lake are not likely to contribute to the spread of new diseases or parasites since they are already exposed to those in the watershed. Tiger salamanders brought from other locations may be a vector for novel diseases or parasites, especially if taken from the wild at another location out of the immediate watershed. Tiger salamanders can act as vectors for diseases that affect other amphibian species, which then can put additional stress on any remaining leopard frog populations in the drainage. Tiger salamanders can also move overland to isolated tanks supporting native leopard frogs and affect the NM gartersnake prey base.

Collection, transport, and use of any tiger salamander at Parker Canyon Lake is prohibited under AGFD regulations. However, this use is known to occur. Illegal use and, more importantly, illegal release of these nonnative tiger salamanders has adverse effects to NM gartersnake prey species in the surrounding watershed, and, may transport novel parasites and diseases. A complete discussion of this issue is contained in the area-wide section of this BCO.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide section). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide analysis discusses this effect in more detail.

Disease and parasites are additional threats to native fish populations and may thus affect the prey base for NM gartersnake. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect roundtail chub. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

Diseases (*Bd* or ranaviruses) associated with nonnative bullfrogs and tiger salamanders also have adverse effects to the native ranid frog prey base, particularly to Chiricahua and lowland leopard frogs. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

### Summary

The status of NM gartersnake in the United States is extremely precarious. NM gartersnake can only be reliably found three disjunct populations; in the Santa Cruz/San Rafael Valley, Tonto Creek from Gisela to Roosevelt Lake, and at the hatcheries on Oak Creek. The effectiveness of created habitat, post renovation of the Bubbling Pond hatchery to maintain the existing population, is uncertain. The Santa Cruz/San Rafael is considered stable and conservation actions are ongoing. The future of the Tonto Creek population is uncertain; it is at low densities and all life stages are not reliably present. The long-term viability of the other populations, based on the very low number of adults documented even in extensive surveys (see discussions in USFWS 2006c, 2008b and 2010g) is in question. At low densities, it can be difficult for males and females to meet, which reduces the opportunity for mating. Additionally, NM gartersnake takes two to three years to mature, and females mate only every other year, which further reduces the likelihood of mating when two NM gartersnake do meet.

With the exception of portions of Las Cienegas NCA, all other populations are in areas with extensive populations of nonnative fish, bullfrogs, and crayfish. Native prey species such as Gila

topminnow, Gila chub, lowland leopard frog, and Chiricahua leopard frog are not widely distributed across the landscape due to the effects on them from these same nonnative species. While bullfrog tadpoles and small metamorphs can serve as prey for NM gartersnake, as adults they are predators on neonate and juvenile NM gartersnake. In several areas where NM gartersnake remain in the United States, we have observed skewed age-class distributions within populations that favor large-bodied, older individuals with significantly fewer newborns and juveniles (Holm and Lowe 1995; Holycross et al. 2006; Wallace et al. 2008). These trends are particularly apparent in areas where habitat remains structurally intact, but where nonnative species maintain stable populations.

The two factors above, in combination, raise significant issues for the persistence of many NM gartersnake populations over the next 10 years. This issue received detailed analysis in the 2008 12-month finding (USFWS 2008b). The summary of that discussion concluded that if we extrapolate the last 20 years of population trends from survey data, unless considerable conservation work is accomplished, the number of populations will decline, and the status of the two currently stable populations may be compromised. This is not to say that the northern Mexican gartersnake, in its entirety, will be extirpated from the United States during this time frame because it would remain plausible that extremely low-density populations of a few individuals may persist in other areas past this time frame.

The status of the species in Mexico is described in detail in the 2008 12-month finding (USFWS 2008b), and while specific status for each known population in Mexico is unclear, available information on significant losses to habitat and prey base from surface water diversions and groundwater pumping, incompatible land uses, urbanization, and other factors indicates NM gartersnake may be declining in Mexico. The expansion of nonnative aquatic species such as bullfrogs, sportfish, and bait fish in Mexico is also of concern for maintenance of the native prey base. NM gartersnake is listed as a threatened species in Mexico; however, that listing of itself does not provide for threat removal.

In the 2008 12-month finding, the USFWS determined that NM gartersnake had a listing priority of 3; which indicates a high and immediate level of threats that are affecting the subspecies. A sub-species cannot, in the USFWS listing priority system, get a higher ranking than 3.

## CONCLUSION

After reviewing the current status of NM gartersnake, the environmental baseline for the action area, the effects of the proposed stocking actions described above, and cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of NM gartersnake. NM gartersnake is a candidate species, so no critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on NM gartersnake for the following reasons:

- The proposed action, through intentional mortality of NM gartersnake by anglers along Oak Creek does not, based on existing population data, have significant effects to the Oak Creek hatcheries population.



- Conservation actions for NM gartersnake in the Santa Cruz/San Rafael Valley through the draft San Rafael HCP may assist in maintaining or expanding that population, and efforts in the vicinity of Parker Canyon Lake may also provide additional support for the small population in Scotia Canyon. Funding for Northern Mexican gartersnake work on Arizona State Parks Land is lacking; but there are few ongoing activities there that are adverse to the NM gartersnake population.
- Most of the sportfish stockings considered in this analysis are of rainbow trout. While rainbow trout are predators on small fish and frogs, they constitute a smaller risk to the native prey base of NM gartersnake than the warmwater species that are extant in those areas. The two warmwater stocking sites in southern Arizona (Arivaca Lake and Parker Canyon Lake) is not likely to support reproducing NM gartersnake populations even without the stocking due to the presence of other nonnative species including bullfrogs and crayfish.
- The spread of diseases that can affect NM gartersnake's native frog prey base through legal and illegal use of nonnative tiger salamanders or bait fish is not connected to the proposed action. Largemouth bass are not proposed for stocking at any site in the Santa Cruz drainage under the proposed action (the warmwater stocking at Pena Blanca Lake is not part of the action under this consultation), although they maintain self-sustaining populations at Arivaca Lake, Parker Canyon Lake, and Patagonia Lake. Native frog populations are not present at these lakes, so there is limited opportunity for direct exposure to any tiger salamanders released into these lakes. There is a continuing risk to native frog populations from release of nonnative tiger salamanders into occupied native frog habitats away from these lakes; however, given the distribution of occupied habitats relative to these sites, that risk is limited in scope.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.
- Conservation measures included in the proposed action will have benefits to NM gartersnake that will assist in offsetting the effects of the proposed action.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly

impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

The prohibitions against taking NM gartersnake found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for this species at this time. The proposed action, through the Conservation and Mitigation Program, is providing conservation measures directed to address potential take that may result from the proposed action. If and when the NM gartersnake is proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement at that time.

#### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

#### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of recovery/conservation strategies for NM gartersnake contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery actions for NM gartersnake under the auspices of the CAMP provides conservation benefits to NM gartersnake that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### **Roundtail chub (*Gila robusta*)**

#### **DESCRIPTION OF THE PROPOSED ACTION**

Roundtail chub are potentially affected by stocking in four major drainages as described in Table 28. New stocking sites or new species proposed for continuing stocking sites are indicated by a \*.

Table 28: Stocking sites, sportfish species proposed for stocking, and potentially affected waters occupied by roundtail chub.

| <b>Stocking complex/ site</b>  | <b>Species stocked</b>       | <b>Roundtail chub locations</b> |
|--------------------------------|------------------------------|---------------------------------|
| <i>Salt River: Black River</i> |                              |                                 |
| Ackre Lake                     | ONMY, THAR                   | Black River                     |
| Big Lake                       | ONMY, SAFO, ONCL, ONAP       | Black River                     |
| Crescent Lake                  | ONMY, SAFO                   | Black River                     |
| East Fork                      | ONMY*, ONAP                  | Black River                     |
| West Fork                      | ONAP                         | Black River                     |
| <i>Salt River</i>              |                              |                                 |
| Canyon Creek                   | ONMY, SATR                   | Canyon Creek                    |
| Workman Creek                  | ONMY                         | Salome Creek                    |
| Salt River Lakes               | ONMY, MIDO, MISA, PONI, ICPU | Lower Salt/Verde                |
| Lower Salt River               | ONMY                         | Lower Salt/Verde                |
| Tempe Town Lake                | ONMY                         | Lower Salt/Verde                |
| Phoenix Urban Lakes            | ONMY, ICPU, LEMA, LEMI, MISA | Lower Salt/Verde                |
| <i>Verde River</i>             |                              |                                 |
| Goldwater Lake                 | ONMY, LEMA, MISA, PONI       | Upper Verde                     |
| Watson Lake                    | ONMY*, LEMA, PONI            | Upper Verde                     |
| Willow Creek Lake              | ONMY*, LEMA, PONI            | Upper Verde                     |
| Oak Creek                      | ONMY                         | Oak Creek                       |
| Wet Beaver Creek               | ONMY                         | Beaver Creek                    |
| Middle Verde                   | ONMY                         | Verde River                     |

|                              |               |                                                         |
|------------------------------|---------------|---------------------------------------------------------|
| West Clear Creek             | ONMY          | West Clear Creek<br>Fossil Creek                        |
| East Verde River             | ONMY          | Fossil Creek                                            |
| Green Valley Lake            | ONMY          | Fossil Creek                                            |
| <i>Little Colorado River</i> |               |                                                         |
| Chevelon Creek complex       | ONMY<br>THAR* | Chevelon Creek                                          |
| Clear Creek Complex          | ONMY<br>THAR  | Clear Creek                                             |
| Clear Creek Reservoir        | ONMY          | Clear Creek                                             |
| <i>Bill Williams River</i>   |               |                                                         |
| Granite Mountain #1          | LEMA<br>LEMI* | Sycamore Creek,<br>Kirkland Creek,<br>Santa Maria River |
| Granite Mountain #2          | LEMA<br>LEMI* | Sycamore Creek,<br>Kirkland Creek,<br>Santa Maria River |
| Bass Tank                    | LEMA*, LEMI*  | Sycamore Creek,<br>Kirkland Creek,<br>Santa Maria River |
| Blue Tank                    | LEMA*, LEMI*  | Sycamore Creek,<br>Kirkland Creek,<br>Santa Maria River |
| Carter Tank                  | LEMA*, LEMI*  | Burro Creek                                             |
| Antelope Tank                | LEMA, LEMI*   | Burro Creek                                             |
| Bar 37 Tank                  | LEMA, LEMI*   | Burro Creek                                             |
| Harman Tank                  | LEMA*, LEMI*  | Boulder Creek                                           |
| Harmon Tank #2               | LEMA, LEMI*   | Burro Creek                                             |
| Little Antelope Tank         | LEMA, LEMI*   | Conger Creek                                            |
| McElhaney Tank               | LEMA, LEMI*   | Boulder Creek                                           |
| Stubb's Tank                 | LEMA, LEMI*   | Boulder Creek                                           |
| Swale Tank                   | LEMA*, LEMI*  | Francis Creek                                           |

Conservation measures included in the proposed action

Roundtail chub is a priority species for conservation in the proposed action and as such, will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

AGFD commits to provide for three roundtail chub populations either through securing existing but threatened populations or establishment of new conservation populations. The first population will be initiated within two years, the second population within four years, and the

third population within six years.

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild or reintroduced populations of roundtail chub.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the AGFC for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

The AGFD shall, within the first two years of the CAMP, develop an assessment of opportunities across the range of the roundtail chub focusing on those with the greatest potential for conservation benefits for the species. This assessment shall tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for roundtail chub and five other native fish species, as that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment shall serve as a guidance document for implementing conservation actions for the roundtail chub.

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

Roundtail chub became a candidate species under the ESA in 2009 (USFWS 2009a).

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the roundtail chub. This information was taken from the 2010 report for the Candidate Notice of Review (USFWS 2010h), which was developed from the 2009, 12-month finding (USFWS 2009a). Information in these documents is incorporated by reference.

##### Life history

Water temperatures of habitats occupied by roundtail chub vary between 32 to 90 degrees Fahrenheit (°F) (0 degrees and greater than 32 degrees Celsius (°C)) (Bestgen 1985). Spawning has been documented from 57 to 75 °F (14 to 24 °C) (Bestgen 1985, Kaeding et al. 1990, Brouder et al. 2000). Spawning occurs from February through June in pool, run, and riffle habitats, with slow to moderate water velocities (Neve 1976, Bestgen 1985, Propst 1999, Brouder et al. 2000, Voeltz 2002). Roundtail chubs live for five to seven years and spawn from age two on (Bestgen 1985, Brouder et al. 2000). Roundtail chubs are omnivores, consuming foods proportional to their availability, including aquatic and terrestrial invertebrates, aquatic plants, detritus, and fish and other vertebrates; algae and aquatic insects can be major portions of the diet (Bestgen 1985, Schreiber and Minckley 1981, Propst 1999).

#### Habitat use

Roundtail chubs in the lower Colorado River basin are found in cool to warm waters of rivers and streams, and often occupy the deepest pools and eddy of large streams (Minckley 1973, Brouder et al. 2000, Minckley and DeMarais 2000, Bezzerides and Bestgen 2002). Although roundtail chubs are often associated with various cover features such as boulders, vegetation, and undercut banks, they are less likely to use cover than other related species such as the headwater chub and Gila chub (Minckley and DeMarais 2000).

#### Current distribution

The roundtail chub is found in the upper and lower Colorado River basins; however, the candidate entity is the Distinct Population Segment (DPS) in the lower Colorado River basin of Arizona and New Mexico (USFWS 2009). Streams containing roundtail chub in the DPS are found in five separate drainages that are isolated from one another (the Little Colorado River, Bill Williams River, Gila River, Salt River, and Verde River), and occupied streams within the drainages have varying amounts of connectivity between them. Using large-scale watersheds, AGFD created “management areas” and “significant conservation units” based on currently occupied roundtail locations. AGFD has utilized new genetic studies (Dowling et al. 2008, Schwemm 2006) to refine these management areas. Based on genetic similarity, the Verde, Salt, and Gila Rivers and their tributaries constitute Management Area A, the Bill Williams and its tributaries are Management Area B, and the Little Colorado River and its tributaries are Management Area C. Further Cantrell (2009), identified Significant Conservation Units or populations based on these new genetic studies constituting genetically similar occupied waters.

Roundtail chub in the lower Colorado River basin in Arizona currently occurs in two tributaries of the Little Colorado River; eight tributaries of the Bill Williams River; the Salt River and 10 of its tributaries; the Verde River and five of its tributaries; Aravaipa Creek (a tributary of the San Pedro River); Eagle Creek (a tributary of the Gila River); and in New Mexico, in the upper Gila River (USFWS 2010g). The Salt and Verde rivers are occupied in several reaches that are fragmented and isolated by two large dams and reservoirs on the Verde River, and four large dams and reservoirs on the Salt River. Roundtail chubs also occur in canals in Phoenix that are fed by the lower Salt and Verde Rivers.

#### Population Status

The initial review of the status of roundtail chub in occupied streams was done in Voeltz (2002) and used the definitions in Table 29 to assign each stream to one of the five categories listed. In the 2009, 12-month finding, we updated the 2002 assessment with new data from various sources, particularly Cantrell (2009) (Table 30). It is important to recognize that these status categories are qualitative. In some cases we have very little information on the population size, length of the stream reach, survivorship, recruitment (survival of young to Age 2, reproductive age), or age structure of the roundtail chub found in the streams. The data used to assign occupied streams to categories varies between sites and in some cases are based on only a few surveys conducted over decadal time scales, so information on trends is generally unavailable. Due to proprietary and confidential survey information, the status of roundtail chub populations in streams on the Fort Apache and San Carlos Indian reservations is unknown.

Table 29: Definitions of status description categories used to describe the status of roundtail chub populations (from Voeltz 2002).

| <b>Status</b>            | <b>Definition</b>                                                                                                                                                                                                                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stable-Secure (SS)       | Chubs are abundant or common, data over the past 5-10 years shows a stable, reproducing population with successful recruitment; no impacts from nonnative aquatic species exist; and no current or future habitat altering land or water uses were identified.                                            |
| Stable-Threatened (ST)   | Chubs are abundant or common, data over the past 5-10 years shows a reproducing population, although recruitment may be limited; predatory or competitive threats from nonnative aquatic species exist; and/or some current or future habitat altering land or water uses were identified.                |
| Unstable-Threatened (UT) | Chubs are uncommon or rare with a limited distribution; data over the past 5-10 years shows a declining population with limited recruitment; predatory or competitive threats from nonnative aquatic species exist; and/or serious current or future habitat altering land or water uses were identified. |
| Extirpated (E)           | Chubs are no longer believed to occur in the system.                                                                                                                                                                                                                                                      |
| Unknown (U)              | Lack of data precludes determination of status.                                                                                                                                                                                                                                                           |

There are 40 historically occupied streams that contained roundtail chub, of which 31 (78%) are extant (Table 30). Some occupied streams are hydrologically connected and individuals can move between occupied streams, and connected stream systems are isolated from other connected systems. Three “Management Areas” were identified for roundtail chub in the DPS; the Gila, Salt and Verde rivers basins (Area A), the Bill Williams River basin (Area B), and the Little Colorado River basin (Area C) using geographical information. Within those three management areas, Cantrell (2009) defined 12 “Significant Conservation Units” (SCUs) identified by geographic isolation of remaining occupied areas, and genetic information developed by Schwemm (2006) and Dowling et al. (2008). The intent of the management areas and SCUs are to focus future management direction on an area versus on a stream-by-stream basis. While this is helpful for management actions, this consultation must look at the effects on

each occupied roundtail chub stream from the proposed action occurring within that stream. We will then look at the additive effects within each area and affected SCU in a summary section.

Table 30: Summary of roundtail chub status and threats by stream reach (Voeltz 2002, Cantrell 2009, USFWS 2009a)

| <b>Location</b>                           | <b>Current Status</b> | <b>Regional historical or current threats</b>                                                                                                                                                                                           | <b>Sportfish stocking effects</b> |
|-------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <i>Management Area A—Gila River Basin</i> |                       |                                                                                                                                                                                                                                         |                                   |
| Aravaipa Creek                            | ST                    | Factor A: Water diversions, groundwater pumping, recreation, mining, livestock grazing, road use<br>Factor C: Nonnative species                                                                                                         | No                                |
| Blue River                                | E                     | Factor A: Water diversions, groundwater pumping, logging and fuel wood cutting, recreation, livestock grazing, road use<br>Factor C: Nonnative species                                                                                  | n/a                               |
| Eagle Creek                               | UT                    | Factor A: Dams, water diversions, groundwater pumping, recreation, mining, livestock grazing<br>Factor C: Nonnative species                                                                                                             | No                                |
| San Francisco River                       | E                     | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                              | n/a                               |
| Upper Gila River                          | UT                    | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                              | No                                |
| Lower Gila River                          | E                     | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                              | n/a                               |
| San Pedro River                           | E                     | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                              | n/a                               |
| <i>Management Area A—Salt River Basin</i> |                       |                                                                                                                                                                                                                                         |                                   |
| Ash Creek                                 | UN (new)              | Factor A: Recreation, logging and fuel wood cutting, livestock grazing                                                                                                                                                                  | No                                |
| Black River                               | ST                    | Factor A: Water diversions, groundwater pumping, recreation, livestock grazing, mining, logging and fuel wood cutting, urban and agricultural development<br>Factor C: Nonnative species                                                | Yes                               |
| Canyon Creek                              | UN                    | Factor A: Livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use<br>Factor C: Nonnative species | Yes                               |
| Carrizo Creek                             | UN                    | Factor A: Livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use<br>Factor C: Nonnative species | No                                |



|                                            |          |                                                                                                                                                                                                                                         |     |
|--------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Cedar Creek                                | UN       | Factor A: Livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use<br>Factor C: Nonnative species | No  |
| Cherry Creek                               | ST       | Factor A: Water diversions, groundwater pumping, mining, recreation, livestock grazing, mining, logging and fuel wood cutting, urban and agricultural development<br>Factor C: Nonnative species                                        | No  |
| Cibecue Creek                              | UN       | Factor A: Livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use<br>Factor C: Nonnative species | No  |
| Corduroy Creek                             | UN       | Factor A: Livestock grazing, recreation, limited fuelwood harvest, limited agriculture, fisheries and wildlife management, and localized municipal, urban and rural development and associated water use<br>Factor C: Nonnative species | No  |
| Salome Creek                               | UT       | Factor A: Recreation, logging and fuel wood cutting, livestock grazing<br>Factor C: Nonnative species                                                                                                                                   | Yes |
| Salt River                                 | UT       | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                              | Yes |
| White River                                | UN       | Factor A: Water diversions, groundwater pumping, recreation, livestock grazing, mining, logging and fuel wood cutting, urban and agricultural development<br>Factor C: Nonnative species                                                | No  |
| <i>Management Area A—Verde River Basin</i> |          |                                                                                                                                                                                                                                         |     |
| Dry Beaver Creek                           | E        | Factor A: Water diversions, dewatering, livestock grazing, logging and fuel wood cutting, recreation<br>Factor C: Nonnative species                                                                                                     | n/a |
| Fossil Creek                               | SS       | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, livestock grazing                                                                                                | No  |
| Oak Creek                                  | UT       | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                                                                 | Yes |
| Roundtree Canyon                           | UN (new) | Factor A: Recreation, logging and fuel wood cutting, livestock grazing                                                                                                                                                                  | No  |
| Verde River                                | ST       | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species                                                                 | Yes |
| West Clear Creek                           | ST       | Factor A: Water diversions, dewatering, livestock grazing, logging and fuel wood cutting, recreation<br>Factor C: Nonnative species                                                                                                     | Yes |

|                                                      |    |                                                                                                                                                                                                                          |     |
|------------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Wet Beaver Creek                                     | UT | Factor A: Water diversions, dewatering, livestock grazing, logging and fuel wood cutting, recreation<br>Factor C: Nonnative species                                                                                      | Yes |
| <i>Management Area B—Bill Williams River Basin</i>   |    |                                                                                                                                                                                                                          |     |
| Big Sandy River                                      | E  | Factor A: Water diversions, groundwater pumping, recreation, mining, livestock grazing, residential development<br>Factor C: Nonnative species                                                                           | n/a |
| Bill Williams River                                  | E  | Factor A: Water diversions, groundwater pumping, recreation, mining, livestock grazing<br>Factor C: Nonnative species                                                                                                    | n/a |
| Boulder Creek                                        | ST | Factor A: Groundwater pumping, recreation, livestock grazing, recreation<br>Factor C: Nonnative species                                                                                                                  | Yes |
| Burro Creek                                          | UT | Factor A: Water diversions, groundwater pumping, recreation, mining, livestock grazing, residential development, contaminants<br>Factor C: Nonnative species                                                             | Yes |
| Conger Creek                                         | ST | Factor A: Groundwater pumping, mining, livestock grazing, recreation<br>Factor C: Nonnative species                                                                                                                      | Yes |
| Francis Creek                                        | UT | Factor A: Groundwater pumping, mining, livestock grazing, recreation<br>Factor C: Nonnative species                                                                                                                      | Yes |
| Kirkland Creek                                       | UT | Factor A: Groundwater pumping, recreation, mining, livestock grazing, residential development, contaminants<br>Factor C: Nonnative species                                                                               | Yes |
| Santa Maria River                                    | UT | Factor A: Groundwater pumping, recreation, mining, livestock grazing, residential development, contaminants<br>Factor C: Nonnative species                                                                               | Yes |
| Sycamore Creek                                       | UT | Factor A: Water diversions, groundwater pumping, recreation, mining, livestock grazing, residential development, contaminants<br>Factor C: Nonnative species                                                             | Yes |
| Trout Creek                                          | ST | Factor A: Water diversions, groundwater pumping, recreation, residential development<br>Factor C: Nonnative species                                                                                                      | No  |
| Wilder Creek                                         | UN | Factor A: Groundwater pumping, mining, livestock grazing, recreation<br>Factor C: Nonnative species                                                                                                                      | No  |
| <i>Management Area C—Little Colorado River Basin</i> |    |                                                                                                                                                                                                                          |     |
| Chevelon Creek                                       | UT | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing, contaminants<br>Factor C: Nonnative species | Yes |
| East Clear Creek                                     | UT | Factor A: Logging and fuel wood cutting, recreation, mining, livestock grazing, contaminants<br>Factor C: Nonnative species                                                                                              | Yes |
| Little Colorado River                                | E  | Factor A: Dams, water diversions, groundwater pumping, dewatering, logging and fuel wood cutting, recreation, mining, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species               | n/a |

|            |   |                                                                                                                                                                         |     |
|------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Zuni River | E | Factor A: Water diversions, groundwater pumping, dewatering, mining, contaminants, urban and agricultural development, livestock grazing<br>Factor C: Nonnative species | n/a |
|------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

### Threats

Threats to the roundtail chub are fully examined in the 12-month finding (USFWS 2009a) and in the 2010 candidate assessment (USFWS 2010h). The information in those documents is incorporated herein by reference. A brief summary is provided below.

Of the populations for which status and threat information is available, all but one of the remaining natural populations is considered threatened by both the presence of nonnative species and habitat-altering land uses. Roundtail chub has been eliminated from much of its historical range because many formerly occupied areas are now unsuitable due to dewatering, impoundment, channelization, and channel changes caused by alteration of riparian vegetation and watershed degradation. In addition, areas where roundtail chub still occurs have been significantly altered or are currently being altered by the same and additional factors, including mining, improper livestock grazing, wood cutting, recreation, urban and suburban development, groundwater pumping, dewatering, dams and dam operation, contaminants, and other human actions. It is important to recognize that in most areas where roundtail chub historically occurred or currently occur, two or more threats may be acting in combination in their influence on the roundtail chub or on suitability of habitat to support the species (Voeltz 2002, Cantrell 2009).

Nonnative species that compete with or prey on roundtail chub are a serious and persistent threat to the continued existence of the roundtail chub. The introduction and spread of nonnative species has long been identified as one of the major factors in the continuing decline of native fishes throughout North America and particularly in the Southwest. The release or dispersal of new nonnative aquatic species is a continuing phenomenon (Rosen et al. 1995, USFWS 2008a). Olden and Poff (2005) identified red shiner, fathead minnow, green sunfish, largemouth bass, western mosquitofish, and channel catfish as the fastest expanding nonnative fish species. These species were also considered to be the most invasive in terms of their negative impacts on native fish communities (Olden and Poff 2005). In Arizona, smallmouth bass are also an expanding species of concern (Bestgen 1985, David Boyarski, AGFD, pers comm.). Nonnative species may affect native fish and other aquatic fauna through numerous means, including predation, competition, aggression, habitat modification, introduction of diseases and parasites, and hybridization. With the exception of hybridization, these effects are relevant to the roundtail chub.

Recent surveys have confirmed some of the information in Voeltz's 2002 status review; in the upper Black River, Chevelon Creek, and East Clear Creek, the species persists in the presence of abundant nonnative predators, and apparently reproduces successfully, but distribution appears limited, abundance is unknown, and other signs, such as abundance of other native fish species, indicate these native fisheries are deteriorating (AGFD 2005, Clarkson and Marsh 2005a, 2005b). Other roundtail chub populations in waters with abundant nonnative predators are less able to reproduce successfully and the particular circumstances at these three sites are worth further investigation. The multi-agency group implementing the Statewide Conservation

Agreement for roundtail chub (AGFD 2006) also recommended against stocking rainbow trout into roundtail chub habitats to reduce the potential for adverse impacts. In addition, this team supported rainbow trout, bluegill, redear sunfish, and crappie stockings in stock tanks and lakes upstream of occupied habitats as the effect to roundtail chub would be minimal.

Warmwater nonnative fish species are particularly predaceous, and Bonar et al. (2004) found that largemouth bass, smallmouth bass, bluegill, green sunfish, channel catfish, flathead catfish, and yellow bullhead all consumed native fish; although roundtail chub was not detected in the diet of any nonnative fishes, this could be due to the relative rarity of the species compared with other native fish, as well as the short time necessary for a fish to be digested. Roundtail chubs have been found in stomachs of largemouth bass in the lower Salt River (P. Unmack, Arizona State University, pers. comm. 2008). Bestgen and Propst (1989) reported that, of nonnatives present in New Mexico, smallmouth bass, flathead catfish, and channel catfish most impacted roundtail chub via predation. Native fishes, including roundtail chub, have experienced significant declines in the Salt River above Roosevelt Lake, concurrent with a significant increase in flathead and channel catfish numbers (Creef and Clarkson 1992 Jahrke and Clark 1999). Brouder et al. (2000), based on population estimates, determined that nonnative species were likely suppressing roundtail chub populations in two areas of the upper Verde River. Yard et al. (2008) found that rainbow trout predation on humpback chub in Grand Canyon likely resulted in significant levels of humpback chub mortality; this predation may be made easier by the young humpback chub suffering thermal shock as they enter the colder mainstem Colorado River. Smaller size classes (juvenile and subadult fish) are more vulnerable to predation because the size of a fish that a predatory fish can consume is limited by the predator's gape size. Brouder et al. (2000) found that size class of native fishes consumed (including roundtail chub) by predatory nonnative fishes in the Verde River was 1.3 to 3.5 in (34 to 90 millimeters (mm)). This predation limits recruitment; with the result that only large adults are encountered during surveys (USFWS 2010). This winnowing effect can result in a population of only large adult fish, which eventually disappears as the adults die off from old age. The issue of predation on YOY roundtail chub is also significant since recruitment events may be attributable to the occurrence of spring flooding, (Brouder et al. (2000) which may not happen every year in controlled river systems.

In a study of the roundtail chub population in the lower Salt and Verde Rivers, Bryan and Hyatt (2004) estimated adult population size of roundtail chub to be 1,657, and found that this was a 74 percent decrease from just 3 years earlier. Bryan and Hyatt (2004) concluded that the roundtail chub population in the lower Salt and Verde rivers was declining rapidly due to low recruitment and high natural mortality, and identified the "negative impacts of competition and predation [from the] introduction of nonnative fishes into roundtail chub habitat" as the likely cause of recruitment failure. The persistence of the stocked warmwater sportfish in the lower Salt and Verde rivers after their initial introductions is the current source of negative impacts. They recommended that stocking nonnative sport fish "be carefully evaluated and probably suspended, especially with regards to predatory species" and that stocking rainbow trout "be thoroughly evaluated to determine its economic impact and the specific impacts to the [roundtail] chub population."

Few if any studies of roundtail chub have effectively demonstrated competition with nonnative fishes, although numerous authors have considered it a threat (Bestgen and Propst 1989; Brouder

et al. 2000, Voeltz 2002, AGFD 2006). Bestgen (1985) found that diets between rainbow trout and roundtail chub differed to an extent that suggested interactive segregation of habitat and competition for food resources, and although the health of the chub population indicated competition was not severe. This information came from 13 rainbow or rainbow x cutthroat trout hybrids taken in Turkey Creek (New Mexico) over several seasons. Turkey Creek is not stocked with trout, and at the higher densities common in stocked trout streams, competition for food may occur during the limited period the stocked trout are present. Marks et al. 2009 found that when nonnative warmwater fish species were removed, roundtail chub numbers and recruitment increased dramatically. Again, whether this is because nonnative species were preying on or competing with roundtail chub is still a question, but perhaps one that is not necessary to answer, for as Marks et al. (2009) illustrate, the removal of these key nonnative stressors allowed for successful roundtail chub recruitment and increases in population size.

### Conservation actions

The AGFD initiated and leads the “Arizona Statewide Conservation Agreement for Roundtail Chub (*Gila robusta*), Headwater Chub (*Gila nigra*), Flannelmouth Sucker (*Catostomus latipinnis*), Little Colorado River Sucker (*Catostomus* spp.), Bluehead Sucker (*Catostomus discobolus*), and Zuni Bluehead Sucker (*Catostomus discobolus yarrowi*)” (AGFD 2006). Recent conservation actions implemented by signatories to the plan are detailed in USFWS (2010) and listed below.

- Acquisition of lands within the upper and middle Verde River by The Nature Conservancy and AGFD that assist in protection of instream flows and adjacent riparian areas.
- Acquisition of lands in Arivaipa Canyon by The Nature Conservancy to enhance flows and restore aquatic habitats for native fish including roundtail chub.
- Efforts by the U.S. Forest Service, AGFD, and SRP to protect stream flows in Cherry Creek and on the Verde River
- Creation of two new roundtail chub populations in Ash Creek and Roundtree Canyon by AGFD.
- Establishment of broodstocks and refugia at AGFD’s Bubbling Ponds State Fish Hatchery of Verde River and Eagle Creek roundtail chub for use in restoration projects funded through the agreement partners.
- The Gila River Basin Native Fishes Conservation Program projects such as Fossil Creek that provide benefits to roundtail chub as part of the benefits to target species.
- Roundtail chub is a covered species under the Horseshoe-Bartlett HCP (SRP 2008) and some recent conservation actions are related to this HCP and undertaken with SRP funding by AGFD.

### Previous consultations

The roundtail chub has only been a candidate for two years and does not have a record of section 7 consultations.

ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Because the proposed actions occur in several watersheds and the significance of effects varies, each watershed is evaluated separately.

## SALT RIVER DRAINAGE

### *Black River*

#### **Description of the Action Area**

The action area extends on the Black River from the stocking sites on the East and West Forks and Fish Creek down to the boundary with the Fort Apache Indian Reservation. This area encompasses the potential dispersal area for stocked trout and Arctic grayling from the stocking areas to the area occupied by the Black River roundtail chub population.

#### **A. Status of the species within the action area**

The Black River roundtail chub population is considered to be stable-threatened (USFWS 2010) with recent surveys documenting recruitment in 2008 and 2008 (Mike Lopez, AGFG, pers. comm.); however, distribution in the system is reduced, abundance is unknown, and the expansion of the smallmouth bass population from the San Carlos Apache and WMAT reservations into the Black River on the ASNF may be leading to a continuing deterioration of this population. Smallmouth bass are not proposed for stocking under the proposed action.

#### **B. Factors affecting the species' environment within the action area**

As identified in Table 30, there are effects to physical habitats in the Black River by a variety of vectors. Flows in the Black River generally follow the natural hydrograph, with some reduction in spring runoff to fill the lakes in the stocking area. Probably the most significant factor affecting the roundtail chub is the presence of nonnative fish (particularly smallmouth bass, and catfish), and crayfish in the action area. It is unclear if the population will continue to recruit with the increased predation and competition from the nonnative species.

The 2011 Wallow Fire burned over a considerable amount of the headwaters of the Black River. The mosaic of burn severity on the landscape is complex, and the full effects to occupied roundtail chub habitat in the mainstem Black River will not be known for some time. Salvage efforts after the fire removed over 100 roundtail chub from the Black River and relocated them to the new population being established in Ash Creek. The post-fire runoff of ash and sediment may have adverse effects to the remaining roundtail chub population, but also to the nonnative

fish, particularly the smallmouth bass. Reduction of the smallmouth bass population may allow for increased roundtail chub recruitment over the short term once normal stream conditions are restored.

## EFFECTS OF THE ACTION

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the roundtail chub are in Voeltz (2002), the 12-month finding (USFWS 2009), the candidate assessment (USFWS 2010). All these documents are incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition by the stocked sportfish species on roundtail chub.

Arctic grayling to be stocked into Ackre Lake may be able to leave that lake when it spills during the spring. Two Arctic grayling were documented in Fish Creek below Ackre Lake, but have not been documented in the Black River. Crescent Lake has not been known to spill; however, Big Lake can spill (last time in 1993). As part of the conservation measures included in the proposed action, a weir will be placed below Big Lake prior to a possible spill to prevent fish from accessing the East Fork Black River. Rainbow trout are established in the cooler portions of the Black River, and with the stocking of triploid trout as a conservation measure, these will not contribute to the maintenance of the wild population. Brook trout also exist in the wild, but cutthroat trout and Arctic grayling do not have wild populations. Rainbow trout stocked into the East Fork Black River are able to move out of the stocking reach downstream into occupied roundtail chub habitat but will not contribute to the wild population.

Native Apache trout stocked into Ackre Lake and the East and West Forks can also move downstream to occupied habitats. It is unlikely that all the Apache trout found in the mainstem Black River are from sportfish stocking events because there are recovery populations in the drainage that also contribute Apache trout to the river during runoff events. All trout species and Arctic grayling are potential competitors for food and space with the roundtail chub, and may prey on young chub. Stocking actions occur in the summer after spring runoff; however, stocked fish can overwinter in the lakes. Summer monsoon rains can displace stocked fish from the East and West Fork during the period when small roundtail chub are present in the system after spawning season. Historically, native Apache trout likely coexisted with roundtail chub, and the number of stocked Apache trout that may access occupied roundtail chub is likely to be low due to angler harvest and natural mortality. Stocked Apache trout can reproduce; however, there is no established population outside of the recovery streams in the drainage.

Take of roundtail chub (which are a legal sportfish in Arizona) by anglers pursuing stocked sportfish is not a significant risk for this population owing to the low numbers of roundtail chub that may be present in the East and West Forks. Recent surveys have not documented roundtail chub in either stream although they may have been present historically. Anglers in the mainstem Black River are not pursuing stocked sportfish, and they are more likely to contact a roundtail chub.

Roundtail chub habitat preferences and aquatic food base are similar to those for the nonnative

trout and grayling. Any stocked fish that move into roundtail chub habitats could compete for space in pools and for forage species while they are present, although the overlap between trout and roundtail chub preferred habitat and forage may be narrow. The extent of potential competition between roundtail chub and trout in the Black River is likely affected by the densities of the species and water temperature. Bestgen (1985) opined that at high densities of trout and cooler temperatures, roundtail chub may not be as successful at maintaining populations as in areas with lower trout densities and higher temperature. It is unclear how long stocked sportfish would persist in the Black River reach currently occupied by roundtail chub.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The stocking sites are all on Apache-Sitgreaves National Forest lands; most activities that could potentially affect these species are Federal activities and subject to additional section 7 consultation.

Use of live bait fish is illegal in the Black River drainage outside of Tribal lands. Use of nonnative tiger salamanders as bait is legal. No use of live bait of any kind to fish for stocked trout or grayling is expected; however, anglers pursuing smallmouth bass may use tiger salamanders as bait.

### *Canyon Creek*

#### **Description of the action area**

The Canyon Creek stocking site is in the upper watershed on the Tonto National Forest. The action area extends from Canyon Creek Hatchery to the confluence with the Salt River. Brown and rainbow trout would not be expected to persist in the lower reaches of Canyon Creek due to high temperatures during the summer; however, they may be present during early spawning of roundtail chub.

#### **A. Status of the species within the action area**

The status of the roundtail chub population in Canyon Creek is unknown. Proprietary survey information on the status of roundtail chub in Canyon Creek on the WMAT reservation is not available for reference in this BCO. Limited survey data exists, with all surveys between 1967 and 1988 in the mid-to lower areas of the creek off the reservation (Voeltz 2002). There are no more recent surveys, and roundtail chub have not been reported by anglers in the stocking reach. The population of roundtail chub in the Salt River near the confluence with Canyon Creek has been heavily impacted by the spread of channel catfish and flathead catfish (Voeltz 2002) and may be extirpated (Creaf and Clarkson 1993, Jahrke and Clark 1999). The population of roundtail chub in the lower portion of Canyon Creek may also have been adversely impacted by



this increase in predators. The population persists at some level, with a few individuals recently documented (AGFD unpublished data).

### **B. Factors affecting the species' environment within the action area**

As indicated in Table 30, the results of land management actions and the spread of nonnative species has affected the status of the roundtail chub in Canyon Creek.

#### **EFFECTS OF THE ACTION**

Both brown and rainbow trout are potential predators and competitors with roundtail chub. Canyon Creek is perennial or interrupted perennial throughout its length and during spring floods or monsoon runoff, connectivity between the stocking sites and the lower part of the creek is present. Both brown and rainbow trout can be displaced downstream during these events. During the winter or early spring, temperatures in the lower part of Canyon Creek may provide for survival of displaced trout until the water temperatures rise in the early summer. During that period, there is a potential for competition for space and food in pools where all three species live. Roundtail chub also breed during this time, so larval fish are at risk of predation. The low numbers of stocked trout likely to reach the potentially occupied habitat of the roundtail chub reduce the significance of this impact. If future surveys identify roundtail populations higher up in the drainage, additional review of this site may be needed.

#### **CUMULATIVE EFFECTS**

The stocking site is on the Tonto National Forest; most activities that could potentially affect these species in the stocking area are Federal activities and subject to additional section 7 consultation. The remainder of the action area is on the Fort Apache Indian Reservation. Federally funded activities do occur on the Reservation and would be subject to section 7 consultation as appropriate.

Use of live bait fish is illegal in Canyon Creek. Use of nonnative tiger salamanders as bait is legal; however, it is unlikely that anglers pursuing stocked trout would use tiger salamanders for bait.

#### *Workman Creek*

### **Description of the action area**

The stocking site at Workman Creek is upstream on a tributary to Salome Creek. The action area extends from the stocking site down to the confluence of Salome Creek with the Salt River. Although there are a series of small waterfalls, there is hydrological connectivity from the stocking site down to the occupied roundtail chub habitat.

### **A. Status of the species within the action area**

Roundtail chub have never been reported from Workman Creek. They are found in Salome

Creek; however, the extent of creek occupied by the species is uncertain. Much of Salome Creek is in steep canyons that limit access for surveys. Surveys in the lower reach near Roosevelt Lake in June of 1979 and October of 1997 found roundtail chub, rainbow trout, and suckers below the falls above Roosevelt (Cooper 1979) and at a location called “The Jug” further upstream below another waterfall (Duncan 1997). Roundtail chub, yellow bullhead and green sunfish were collected in 2000. The presence of rainbow trout in the lower elevations in June and October supports the idea they can persist in this reach year round. It is unknown if they reproduce or move into the roundtail habitat with high flows. Surveys in 2000 found no roundtail chub in Salome Creek above the confluence with Workman Creek (Voeltz 2002). Green sunfish and brown trout were identified in the upper area. Salome Creek has a series of small waterfalls and other features that make upstream movement from what was its confluence with the Salt River (now at Roosevelt Lake), so the historical extent of roundtail chub in the creek may have been limited by physical factors.

No comprehensive surveys have been conducted in Workman Creek since 1994, during which only rainbow trout were observed. In 1974, a survey was conducted and rainbow, brown and brook trout were the only species reported. In 2006, a visual survey was conducted from the Hells Hole Trailhead on SR 288 to the confluence of Salome Creek. Longfin dace and rainbow trout were observed (Gill 2006). Rainbow trout young were detected, indicating the occurrence of natural reproduction in the lower end of Workman Creek.

In Salome Creek, downstream of Workman Creek, rainbow trout, roundtail chub, desert sucker, and green sunfish were collected in 1997. Roundtail chub, yellow bullhead, and green sunfish were collected in 2000. Upstream of the Workman Creek confluence in Salome Creek, only green sunfish were collected in 1994 and 2000 surveys (Voeltz 2002). The Salome Creek roundtail chub population is designated as unstable-threatened with the major threat being green sunfish (Voeltz 2002).

## **B. Factors affecting the species’ environment within the action area**

As indicated in Table 30, the results of land management actions and the spread of nonnative species has affected the status of the roundtail chub in Salome Creek.

### **EFFECTS OF THE ACTION**

Surveys in 2006 found rainbow trout in Workman Creek above the confluence with Salome Creek (Gill 2006). The presence of small rainbow trout in November implies reproduction from earlier in the year. With one data point, it is hard to assess if the rainbow trout are self-sustaining in Workman Creek. The conversion to triploid rainbow trout under the proposed action will eliminate the potential for stocked trout to support the extant wild population by 2013. The rainbow trout stocked in the upstream stocking reach can move down the creek toward Salome Creek as the stream is perennial between the two points. Rainbow trout were reported from lower Salome Creek (Duncan 1997) in habitat shared with roundtail chub. Rainbow trout can be competitors for food and space with roundtail chub, and may also prey on young chub (Propst et al. 1998). The rainbow trout at “The Jug” were upstream of waterfall barriers and it is plausible they came from immediately upstream in Reynolds Creek (stocked in the 1940s) or from

Workman Creek. Only brown trout were identified in upper Salome Creek, which supports either Reynolds Creek or Workman Creek as the source of rainbow trout in roundtail chub habitat.

## CUMULATIVE EFFECTS

The stocking site is on the Tonto National Forest; most activities that could potentially affect these species in the stocking area are Federal activities and subject to additional section 7 consultation.

### *Lower Salt River*

The lower Salt River stocking area includes three large mainstem reservoirs, the lower Salt River below Stewart Mountain Dam, Tempe Town Lake, and urban fishing lakes in the Phoenix metropolitan area. As identified in Table 28, both warm water and cold water species are included in the proposed action.

### **Description of the action area**

The action area is the lower Salt River from Stewart Mountain Dam downstream to the confluence with the Gila River, those urban lakes with physical connections to the Salt River or the Salt River Project Canal system, Tempe Town Lake, and the Verde River from Bartlett Dam to its confluence with the Salt River. This encompasses the area where stocked fish species may encounter roundtail chub from the lower Salt/lower Verde populations. Some of the urban lakes are isolated from the rest of the system and effects from fish stocking there are unlikely.

### **A. Status of the species and critical habitat within the action area**

The roundtail chub is found in the lower Salt and Verde Rivers as a contiguous population, with the SRP canals also holding individuals of the species (Bryan and Robinson 2000, Bryan and Hyatt 2004). The population was estimated at 1,657 (95% confidence interval [CI] = 1,097-2,742) in 2003 (Bryan and Hyatt 2004), a decrease of 46-74% from the 2000 estimate of 6,424 (95% CI = 5,048-8,397) (Bryan and Robinson 2000). The majority of the population is in the upper portion of the Verde River reach (below Bartlett Dam) where there are more of the preferred habitat types present (Bryan and Robinson 2000, Bryan and Hyatt 2004). Bryan et al. (2000) believed that the Verde River was the focus of the roundtail chub population, with the Salt only supporting a limited number of adults. Spawning by roundtail chub in the Salt River was not documented even though adults in breeding colors were observed. The authors believed that the Salt River fish went to the Verde River to spawn.

The decline in population size is likely due to natural mortality of adults and insufficient recruitment to replace them. The flows in the rivers in spring 1998 allowed for a large, successful spawn and recruitment to the population and the passage of that cohort to adult status was documented in the two studies already referenced in this section and in Brouder et al. (2000) and Brouder (2001). The lack of significant levels of recruitment since then, and the dying off of the 1998 cohort due to old age (roundtail chub may reach 11 or more years of age [AGFD

unpublished data cited in Bryan and Hyatt 2004] but five to seven years is more usual [Bestgen 1985]). The CAP surveys since 1995 have only documented eight roundtail chub in the lower Salt River and those taken in the canals also show a downward trend. The 1998 cohort was also noted in fall CAP collections from that year (Marsh 1999), with 475 0+ and 70 1+ individuals taken in the South Canal and 249 0+ taken in the Arizona Canal. That year, only one 1+ roundtail chub was taken from the Salt River.

The SRP canals also act as a population sink for roundtail chub in this population. Once individuals enter the canals and move below the electrical fish barriers, they are lost to the riverine population at Granite Reef Dam. Of the roundtail chub recorded by the CAP surveys, the vast majority were taken from the two canals. The decline over time of the numbers of roundtail chub in the canals may be indicative of the decline of the population in the river; however the amount of monitoring is not sufficient to make this correlation. While roundtail chub are documented in the canals, they have not been documented in the urban lakes or in Tempe Town Lake.

Aside from the yearly CAP monitoring surveys, the most recent effort to evaluate the roundtail chub population in the lower Verde and lower Salt Rivers was conducted in 2003 (Bryan and Hyatt 2004). The lack of numbers similar to the 1998 recruitment event implies that no similar recruitment has occurred since. Bryan and Hyatt (2004) hypothesize that the roundtail chub may continue to decline due to senescence of the 1998 cohort and recommended, among other research, that the introduction of rainbow trout into the lower Salt River be evaluated for its effect on the roundtail chub.

## **B. Factors affecting the species' environment within the action area**

Flows in the lower Salt and Verde rivers are controlled by Salt River Project and releases are made to meet water rights and for hydropower generation. There are seasonal differences in releases from the Salt and Verde river dams, with Salt River flows very low in the winter to early spring and flows in the Verde supplying most of the flows for water users, then reductions in Verde River flows during the summer and fall as more water is released from the Salt. During periods of high runoff, flood releases are made as needed to control reservoir levels and reduce the amount of water spilled downstream. The bed of the Salt River down to its confluence with the Gila River is normally dry except where urban runoff creates some surface water, in the Rio Salado riparian restoration area, and below the 91<sup>st</sup> Avenue water treatment plant where treated effluent is released into the river.

The lower Salt and Verde rivers contain a significant population of nonnative predatory fish species (Brouder et al. 2000, Bonar et al. 2004, Bryan and Hyatt 2004). The suite of other nonnative species in the lower Salt River, particularly largemouth bass, green sunfish, and channel catfish, are potential predators on roundtail chub eggs, larvae, and juveniles, and are likely to be more significant predators than the hatchery-raised rainbow trout (Bonar et al. 2004).

## **EFFECTS OF THE ACTION**

The roundtail chub population in the lower Salt and Verde Rivers has experienced significant

declines since 1998 that are likely still continuing. The majority of the population likely remains in the Verde River below Bartlett Dam (Bryan and Robinson 2000), and the number of roundtails captured in the lower Salt River is consistently low (Bryan and Robinson 2000, Bryan and Hyatt 2004, Brouder et al. 2000), although capture probabilities may also affect actual numbers as described by Bryan and Robinson (2000). Movement of roundtail chub between the two rivers is both hampered and facilitated by SRP's management of the system. High Verde River flows in the winter can transport roundtail chub to the lower portion of the river above the confluence with the Salt River (Bryan and Robinson 2000) and higher Salt River flows in the summer allow fish to move within that reach. Generally, roundtail chub recaptured after several months had not apparently moved far from the capture site (Bryan and Robinson 2000). The origin of the roundtail chubs found in the SRP canals is likely from the more robust Verde River population; however, during high flows down the Salt River, roundtail chub may be transported to the canals.

While rainbow trout are the least piscivorous of the trouts, stocking rainbow trout into the lower Salt River may result in competition for food and space between the trout and roundtail chub as they share similar habitats (Bryan et al. 2000), though the extent of overlap is unknown (Bestgen 1985). Stocked rainbow trout are known predators on native fish (Propst et al. 1998). The limited amount of habitat present during the winter months provides opportunity for exposure. Roundtail chub prefer pools and pool-glide habitats adjacent to riffles (Bryan and Robinson 2000), and in the lower Salt River during the low flow period during the winter months pool habitat is most of what is available (Bryan et al. 2000). The twice-monthly stocking of rainbow trout during this period provides a continued pulse of nonnative species into the river and limited habitats. Roundtail chub are also spawning during the stocking period in the Verde River, but larvae may come into contact with stocked rainbow trout if they move down below the confluence with the Salt. Bonar et al. (2004) reported that stocked rainbow trout had the second-highest daily ration of fish in their diet (after largemouth bass), and, even though no native fish were found in the gut contents, the size of fish taken as prey are available during the time the rainbow trout are present. Rainbow trout were significantly less piscivorous than the nonnative warmwater species; however, in large numbers post-stocking in the available pool habitats, there is an opportunity for competition or predation. Stocked rainbow trout are rapidly removed by angling and natural mortality but repeated stocking over the season maintains some level of presence. Bonar et al. (2004) recommended additional evaluation of rainbow trout piscivory on native species in the Verde River. Bryan et al. (2000) and Bryan and Hyatt (2004) both include concerns about competition for food and space between stocked rainbow trout and roundtail chub in the stocking reach. They also concluded that recruitment and maintenance of the roundtail chub population was dependent on high flow events during the spring spawning season. Since these events do not happen every year, recruitment in non-flow years may be more limited due to predation, particularly by warmwater species. The multi-agency group implementing the Statewide Conservation Agreement for roundtail chub (AGFD 2006) also recommended against stocking rainbow trout into roundtail chub habitats to reduce the potential for adverse impacts.

Stocking of walleye sac fry and fingerlings into Apache, Canyon, and Saguaro lakes would occur annually to support that fishery since the adults do not spawn in the lakes. Stocking of other warmwater species would only occur to augment the fishery following catastrophic events. An example of when this would occur is after a golden algae bloom that results in a significant fish kill. Fish populations would recover over time without such stocking; however, it is included as

a means to “jumpstart” expansion of the populations in the lakes.

Fish in the lakes can move between lakes, and can access the lower Salt River below Saguaro Lake. The nonnative fish community, particularly the largemouth bass, is robust in the river. Bonar et al. (2004) identified largemouth bass as the most significant nonnative fish predator on native fish species in the lower Verde River. Largemouth bass also concentrate in pools and runs; habitat more likely to be used by native fish including roundtail chub. Except for walleye and black crappie, the other warmwater species included in the proposed action are likely self-sustaining in the lower Salt and Verde rivers. It is unclear if any die-offs similar to those in the lakes also affect the rivers.

The urban lakes proposed for stocking are scattered across the Phoenix metropolitan area. Most are fed from the SRP canals but are isolated from them by pipes, gates, or other obstructions. Small roundtail chub can enter some of these lakes from the canals, but would be unable to leave once grown. No roundtail chub have ever been detected in the urban lakes. We do not anticipate any significant effects to roundtail chub populations in the Salt River due to stocking actions in the urban lakes or at Tempe Town Lake.

## CUMULATIVE EFFECTS

Flows from the Salt and Verde River dams are controlled by SRP for efficient use of water and not to meet environmental needs.

The loss of individuals to the SRP canal system at Granite Reef Diversion Dam and flow releases from Bartlett Dam during the spring spawning period may remove adults from the system. Once individuals get below Granite Reef Diversion Dam and the electrical barriers in the canals, they are lost to the river populations, and this may be particularly important in the loss of adult spawners from a small population. Roundtail chub were not detected in the Salt River by CAP surveys in 2005 and 2009, though it was detected in the previous 10-year period (Kesner and Marsh 2010). There are still a few roundtail chub captured in the canals during the CAP monitoring, so the population is persisting, perhaps in the Verde River.

Bait fish and tiger salamanders are legal for use in the lower Salt River and its reservoirs. Stocking actions to maintain warmwater fish communities perpetuate the use of live bait in the system.

### *Little Colorado River*

#### **Description of the action area**

The action area for Chevelon Creek extends from the stocking sites downstream to the Apache-Sitgreaves National Forest boundary. For East Clear Creek, it extends from the headwaters of East Clear Creek, including those tributaries with stocking sites down to the confluence with the Little Colorado River.

#### **A. Status of the species within the action area**

Roundtail chub populations in East Clear Creek and Chevelon Creek are unstable-threatened. In Chevelon Creek, roundtail chubs are found in the creek below Chevelon Lake downstream at least to the Chevelon Creek gaging station just north of the national forest boundary. Surveys at four locations within this reach in August, 2005 (McKell 2005) documented roundtail chub, speckled dace, and Little Colorado sucker present. Nonnative fathead minnows dominated the fish community (although speckled dace were almost as dominant), and crayfish were abundant. Brown trout were seen at the Durfee Crossing site but not reported at the other three sites. There was evidence of recruitment of roundtail chub, with adults, subadults, and juveniles captured. The extent of the survey is not sufficient to assess the strength of the population.

In East Clear Creek, roundtail chubs are found from Macks Crossing downstream to Clear Creek Reservoir. Surveys at three locations in August, 2005 (Clarkson and Marsh 2005) documented roundtail chub in multiple age classes, including young of the year in the creek. Nonnative fish numbers were also high; with large numbers of fathead minnows and green sunfish. No trout were recorded; however, temperatures had likely exceeded the thermal tolerance for trout by the time of the surveys.

Efforts to capture roundtail chub from East Clear Creek and move them to a refuge facility at Raymond Wildlife Area were accomplished in 2006 and 2007 (AGFD 2006, 2008). No reports on persistence at the refuge site are available. Similarly, roundtail chub from Chevelon Creek were moved to Silver Creek State Fish Hatchery in 2007 and 2008. Unfortunately, most individuals were lost to disease (Cantrell 2009).

## **B. Factors affecting the species' environment within the action area**

As shown in Table 30, water diversions, improper livestock grazing, timber management, and nonnative species have adverse effects to roundtail chub in the action area. Wildfires also put the populations at risk from toxic ash flows or sedimentation off burned areas, and fire-retardant drops. Drought is a significant issue, as flows in both creeks are largely dependent on runoff from precipitation events. The presence of dams on the only perennial tributaries reduces the amount of water moving downstream during runoff events if the lakes are not full. During drought periods, flows may be significantly constrained.

## **EFFECTS OF THE ACTION**

The four Chevelon Creek stocking sites are hydrologically connected, with Chevelon Canyon Lake the lowest site in the drainage. Any water releases from Long Tom Tank, Willow Springs, or Woods Canyon Lake enter Chevelon Canyon Lake, which spills in the spring following runoff events that fill the system. The reach of Chevelon Creek below the lakes does not maintain perennial flows following spring runoff; however, there are isolated pools that can persist through the summer and may be augmented by summer monsoon flows in the tributary watersheds.

Rainbow trout are stocked in all four lakes, with Arctic grayling also stocked in Chevelon Canyon Lake. Rainbow trout and Arctic grayling can persist year-round in Chevelon Canyon

Lake but do not reproduce in the lake; however, there may be some reproduction of rainbow trout in the perennial reach of Chevelon Creek between Willow Springs/Woods Canyon lakes and Chevelon Canyon Lake. Stocking of triploid rainbow trout under the proposed action will essentially eliminate stocked trout from supporting the wild populations. Any spills from Chevelon Canyon Lake in the spring can displace rainbow trout and Arctic grayling downstream. Trout and grayling that overwinter in the system have adapted to natural foods and may be more predatory than recently stocked individuals. Because habitats become isolated during the summer, competition for food and space in pools is more likely to occur between trout, grayling, and roundtail chub since there are fewer habitat options available, and predation on young of the year roundtail chub by rainbow trout may also occur.

Rainbow trout have been documented below Chevelon Canyon Lake five times in surveys spanning 1965 through 1991. Surveys below the dam and at two sites above the West Chevelon Creek confluence (10.5 miles below the dam) in 2005-2008 have not documented any rainbow trout; however, these surveys were done in August and September which may be too late in the year to detect rainbow trout due to temperatures in the isolated pools exceeding their thermal tolerance. Arctic grayling have a lower thermal tolerance than rainbow trout, and are likely to die off sooner in the year. Rainbow trout may be present through most of the roundtail spawning season but will not establish in this portion of Chevelon Creek.

This complex contains three stocking sites in the headwater areas of East Clear Creek (Bear Canyon Lake, CC Cragin Reservoir, and Knoll Lake) and one site near the confluence with the Little Colorado River (Clear Creek Reservoir). Rainbow trout are proposed for stocking in all sites, with Arctic grayling also proposed for Bear Canyon Lake. Neither species reproduces in any of the lakes, but can carry over to the next stocking season in the three high-elevation sites. Stocking into CC Cragin Reservoir and Knoll Lake is restricted to after the lakes spill under a biological opinion to protect Little Colorado spinedace below the lakes. This also provides protection for roundtail chub.

Bear Canyon Lake is located on an ephemeral tributary of Willow Creek, which joins East Clear Creek approximately one mile above Hamilton Crossing. Bear Canyon Lake fills and spills from spring runoff every year; no other water is released downstream from the lake. Bear Canyon below the lake may hold some isolated pools outside of the runoff season. Willow Creek is not perennial, flowing to East Clear Creek only during the spring runoff, but it does have some permanent water between Gentry Creek and Cabin Draw in the form of large, deep pools. Trout or grayling that exit Bear Canyon Lake during spring runoff may be able to persist in the deep pools through the summer. One rainbow trout was found immediately below the dam, but none were found in surveys in 1999, 2000, or 2004-2005.

Clear Creek Reservoir may have roundtail chub present in or upstream from where stocked rainbow trout may move from the lake. There may be some overlap in roundtail chub spawning season with trout presence, which can lead to predation risks. Competition for food and space is likely with larger chub but would be limited due to high summer water temperatures that preclude trout survival.

## CUMULATIVE EFFECTS



Stocking sites are on Federal land. Water management at CC Cragin is by SRP and on Knoll Lake and Chevelon Creek by AGFD-owned water rights. Groundwater diversions are likely to eliminate flows in the lower portions of both creeks over the next 50 years. Lower Chevelon is most at risk, because the flows there are from groundwater springs connected to the aquifer, and Clear Creek maintains some surface flows.

## VERDE RIVER

### *Upper Verde River*

#### **Description of the action area**

Watson, Willow, and Goldwater lakes are the stocking sites that may have effects to the roundtail chub population in the upper Verde River. The action area is the Granite Creek drainage to its confluence with the Verde River, and downstream on the Verde River to the Pecks Lake Diversion.

#### **A. Status of the species within the action area**

Brouder et al. (2000) identified the roundtail chub as fairly common in the upper Verde River; however, it has experienced declines since the late 1990s. In annual surveys from 1994-2008, roundtail chub numbers dropped significantly across the entire reach (Rinne combined data by Albert Sillas, USFS). Voeltz (2002) indicated they were still fairly common but did reference data from the above surveys as showing declines. AGFD standardized surveys from 2002-2006 did not show a distinct trend; however, numbers were highly variable between surveys. However, in 2005 and 2006, surveys indicated that recruitment had occurred after the high spring flows in 2005. AGFD collections for the broodstock collected over 900 roundtail chub with 100 chub taken from three sites in the reach (Cantrell 2005). Roundtail chub from this broodstock at Bubbling Ponds Hatchery were stocked into Stillman Lake in 2010 after the renovation was completed.

#### **B. Factors affecting the species' environment within the action area**

As discussed in USFWS 2009 and 2010, the upper Verde River is particularly threatened by reductions in flows due to groundwater pumping in the Big Chino Aquifer. The expansion of the nonnative fish population in the reach is also having significant adverse impacts to the roundtail chub population. Conservation actions by AGFD and The Nature Conservancy that purchased private lands in the upper portion of the spinedace critical habitat reach allows for enhanced management of the riparian areas that are part of the lateral extent of the critical habitat and reduces the risk of introduction of nonnative aquatic species at those sites. The Gila River Basin Native Fishes Conservation Program is involved with planning for a fish barrier in the reach that would allow the eventual renovation of the reach to remove nonnative species. Nonnative removal efforts at Stillman Lake in 2009 are an example of the types of future conservation actions envisioned.

## EFFECTS OF THE ACTION

Effects of the stocking of sportfish into the Granite Creek reservoirs would occur if stocked fish or their progeny escape from the reservoirs during controlled releases or flood flows and access the upper Verde River. The potential for escapement from the Granite Creek stocking sites is limited to periods when the reservoirs spill. Such winter events possibly occurred three times between 1965 and 1984 and definitely in January and February 2005, January 2008, and January 2010. All species proposed for stocking (except rainbow trout) are already in one or more of the Granite Creek reservoirs (black crappie was known historically from all three but is only currently documented from Watson Lake), and stocking under the proposed action does not increase the potential for these species to reach the Upper Verde River.

Largemouth bass are of particular concern due to their high level of predation risk to small native fish. Black crappie over 100 millimeters switch from being planktivores to focusing on threadfin shad (Minckley 1973), and thus pose a predation risk to small roundtail chub. Bluegills are not particularly predaceous, but do consume fish larvae or small fishes on occasion (Minckley 1973). Stocked rainbow trout are documented feeding on loach minnow (Propst et al. 1998), and are capable of preying on small roundtail chub. The risk of predation by these species on roundtail chub is facilitated by the shared preference for pool habitats by the four nonnative species. Competition for food may also occur with rainbow trout during the spring when temperatures in the upper Verde River can support trout.

The seven-site survey information that documented the decline of the roundtail chub in the upper Verde River also contains information on the numbers of individuals of stocked species found. Since these surveys take place in summer, it would not be expected that rainbow trout would be detected. Bluegills (three) were found in 1992 but not since, and black crappies have not been found during those, or any other surveys in the upper Verde River. Largemouth bass have been found a total of eight times between 1966 and 2005 with 19 individuals recorded (Table 31). All but the 2004 and 2005 records are below the Verde-Granite Creek confluence; however, the remaining two are from Stillman Lake which may be connected to Granite Creek at high flows. Largemouth bass are not proposed for stocking into Watson or Willow Creek lakes (only Goldwater, which is upstream of Watson Lake); however the species maintains populations in all three lakes. The opportunity for largemouth bass in Goldwater Lake to reach Watson Lake exists due to connectivity; however, it is very low and any largemouth bass found in the upper Verde is more likely to come from Watson or Willow Creek lakes. It is unknown how long a bluegill, black crappie, or largemouth bass could persist in the upper Verde River once access was gained. Preferred habitats for these species may be limited, but is not unavailable and other habitats can support individuals for perhaps extended periods. During the time these individuals are present, there is opportunity for increased predation and/or competition with roundtail chub.

Table 31: All located largemouth bass records for Upper Verde River

| Date       | Location                   | Number | Source          |
|------------|----------------------------|--------|-----------------|
| 1966       | T18NR1E (near Bear Canyon) | 1      | SONFISH         |
| 12/11/1989 | T17NR2W sec 12 (confluence | 1      | SONFISH, likely |

|                 |                                            |                            |                                                                       |
|-----------------|--------------------------------------------|----------------------------|-----------------------------------------------------------------------|
|                 | Granite Creek                              |                            | record from Hendrickson 1993 survey data                              |
| 7/18/1990       | T17NR2W sec 12 and 14 (below Granite Creek | 5                          | SONFISH, likely record from Hendrickson 1993 survey data              |
| 2/5-6/1991      | T17NR2W section 15 (Sullivan Lake?)        | 2 (also 3 channel catfish) | SONFISH, likely record from Creef, Clarkson, and McGuinn-Roberts 1992 |
| 9/25-10/29/1992 | Morgan Ranch to Perkinsville               | 6 (also 4 channel catfish) | Creef and Clarkson 1993                                               |
| 2000            | Near Sycamore Creek                        | 1                          | Rinne compiled data                                                   |
| 2004            | Stillman Lake                              | 1                          | Cited USFWS 2009                                                      |
| 2005            | Stillman Lke                               | 2                          | Cited USFWS 2009                                                      |

As these species are present in one or more of the Granite Creek reservoirs and have not established populations in the upper Verde River, the likelihood that they will do so in the future is uncertain. The effect of the small numbers of individuals that may be displaced into the upper Verde River from the Granite Creek stocking sites does not alter the existing predator and competitor community in the river. There is no additive effect of stocked sportfish accessing the Verde River would increase the numbers of nonnative fish over the period covered by this consultation, and increase predation and/or competition pressures.

#### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Granite Creek stocking sites are on private lands and activities on the lakes, including scheduling water releases for flood control or other purposes are subject to non-Federal management. A portion of the watershed for the upper Verde River is on private and state lands where management actions are directed by non-Federal parties. The most proximal portion of the watershed is on the Coconino National Forest, where land management actions are subject to section 7 consultation.

The use of live baitfish is prohibited at waters in Yavapai County, including the Granite Creek stocking sites, so there is little impetus for anglers to introduce these species to the upper Verde River to create sources for use in the Granite Creek stocking sites. Tiger salamanders are legal; and may be used at Goldwater Lake for stocked largemouth bass and at the other two lakes for the wild bass population. Of the nonnative species that maintain populations in the upper Verde River, only red shiner (a species used for bait in other portions of the state) were stocked into one

of the reservoirs (Watson); fathead minnow and green sunfish are other bait species that were likely illegally introduced to the upper Verde River in the past and now maintain populations in the river. Some of the records for largemouth bass, particularly those at Stillman Lake, may also be the result of illegal stockings. The area-wide analysis will look at the effects of illegal or inadvertent transport of unwanted aquatic organisms on the larger scale.

### *West Clear Creek*

#### **Description of the action area**

West Clear Creek is affected by two rainbow trout stocking sites; Huffer Tank and lower West Clear Creek. The Huffer Tank action area extends from the stocking site at Huffer Tank to the confluence with the Verde River and includes connected tributaries of West Clear Creek within that reach. The lower West Clear Creek action area is from the stocking site downstream to the confluence with the Verde River.

#### **A. Status of the species within the action area**

The taxonomic status of the *Gila* species in the upper portion of West Clear Creek is under debate. Roundtail chub was identified as the species in lower West Clear Creek and Voeltz (2002) included all of West Clear Creek as supporting roundtail chub based on Minckley and DeMarais (2000). Our 12-month finding on the petition to list headwater chub did not include West Clear Creek as a headwater chub population (USFWS 2006), which implies it was considered to be roundtail chub at that point. It was included as a roundtail chub population in our 12-month finding for the discrete population segment of roundtail chub (USFWS 2009).

The FWS did, in its 2008 candidate notice of review annual assessment of that status of headwater chub, include upper West Clear Creek as a headwater chub stream based on information from Schwemm (2006), who evaluated genetic variation in the *Gila robusta* complex. However, this designation has been challenged (Stefferd et al. 2009) based on several factors including the location in West Clear Creek where the chub for Schwemm's work were obtained (the lower reach below the waterfall). Additional work on microsatellites (Dowling et al. 2008) from the same areas as Schwemm (2006) placed the West Clear Creek (upper and lower) population as roundtail chub. The taxonomic status of chub in upper West Clear Creek has still not been resolved; however, the most recent findings do not place them clearly with either species (Dowling 2010). We include the analysis for upper West Clear Creek with the sites for roundtail chub since it is included as roundtail chub in our 2009 finding of warranted-but-precluded for roundtail chub (USFWS 2009a).

Survey data for upper West Clear Creek are very limited, with as few as seven events recorded in Voeltz (2002) that can be placed in the creek above the barrier falls. No information on the number or sizes of roundtail chub reported by these surveys was provided. The only reference to numbers is that they were "common" around Tramway Trail in 2001 and some were reportedly caught on hook and line. Two brief additional surveys, one in 2002 (West Clear Creek Survey 2002b) and one in 2004 (Rinker 2004) were conducted near Tramway Trail. Both of these used backpack electroshockers, which are not generally able to effectively sample deep pools. The

2002 effort targeted two pool areas and one riffle. Two small rainbow trout (64 and 134 mm) and one brown trout (174 mm) were captured in the pools and three roundtail chub (67-73 mm) were captured in the riffle. The 2004 effort had three, 50-meter stations that included both pool and riffle areas and again used electroshocking. One small rainbow trout (not measured, but perhaps 150 mm) and one brown trout (90 mm) were taken along with 20 roundtail chub ranging from 25 to 218 mm. The size of the trout captured indicates that reproducing populations exist. The roundtail chub made up only six percent of the total number of fish captured (speckled dace dominated the catch at over 76 percent), but may exist in larger numbers in the deeper pools that could not be sampled. The information presented in published reports (Voeltz 2002, West Clear Creek 2002, and Rinker 2004) is sparse and the size of the roundtail population or the nonnative trout population in West Clear Creek above the barrier falls is not available. Data from surveys in 2008 (Cantrell 2008) determined the West Clear Creek population (in its entirety) to be stable-threatened on the basis that they were the most abundant species from the Tramway Trail crossing and the natural barrier above Bull Pen Campground, with data over the last five to 10 years indicating a stable, reproducing population with successful recruitment.

Survey data for lower West Clear Creek indicates significant declines in that portion of the population, which is identified as roundtail chub. Brouder et al. (2000) documented multiple year classes present. This information was used in Voeltz (2002) as part of the basis for the stable-threatened determination. In 2002, roundtail chub were still present (West Clear Creek 2002a), but by 2008, the population had been largely replaced by smallmouth bass and other nonnatives (Rinker et al. 2008).

## **B. Factors affecting the species' environment within the action area**

Most of upper West Clear Creek is in a wilderness area. There are some roads and hiking trails that access portions of the creek. There are no diversions off the creek; however, there are some stock tanks in the watershed. Livestock and elk grazing may affect the watershed, and wildfire is a continuing concern. Nonnative species (rainbow trout, brown trout, and fathead minnow) are present as reproducing populations in this reach. The extent to which these nonnative species affect the roundtail chub population is unknown.

The lower portion of West Clear Creek is heavily impacted by roads, water diversions, recreational areas, and other human activities. The robust nonnative fish populations now present in this reach have likely had significant adverse effects to the roundtail chub population.

## **EFFECTS OF THE ACTION**

Stocking up to 4,000 rainbow trout into Huffer Tank between April and October each year may create a continuing source of rainbow trout in part of the headwaters until 2013 when triploid rainbow trout will be used for stocking this site. There is no other stocking location in the upper West Clear Creek drainage; there are, however, wild rainbow and brown trout populations that resulted from past stocking actions in the drainage. The number of stocked rainbow trout that could be transported from Huffer Tank during winter/spring or summer monsoon events is unknown, as is the frequency of spills from the tank that could transport fish downstream. The tank is on a small drainage and spills may be infrequent. The amount of current augmentation of

the existing wild trout populations by fish from Huffer Tank is unknown and this will be reduced after the conversion to triploid trout. The effects of the existing wild trout populations on roundtail chub are unknown. The potential additive effect of stocking rainbow trout into Huffer Tank on roundtail chub in upper West Clear Creek is likely to be limited in scope due to the low frequency of spills from the tank and the limited number of fish to be stocked until 2013. Any rainbow trout that did escape Huffer Tank and reach West Clear Creek could persist, as conditions are suitable for trout all year. There is potential for competition for food and space, and for predation on small roundtail chub.

Stocking up to 6,000 rainbow trout at Bullpen Campground in March through May and October through November adds an additional competitor during those two periods and potential predator in the spring during the spawning season for roundtail chub. While this portion of the West Clear Creek population was determined to be stable-threatened in 2002 (Voeltz 2002), the present conditions reflect an unstable-threatened status. The roundtail chub in the lower creek may be primarily supported by individuals displaced from the upper sections, not by local recruitment or roundtails moving up from the Verde River. Small chub would most be at risk from nonnative competition and predation, including a component attributable to rainbow trout. Summer temperatures are not conducive to rainbow trout persistence in or below the stocking reach, so any roundtail chub moving into the lower reach during the summer would not be exposed to competition with rainbow trout until the stocking resumed in October.

Trout stocked into West Clear Creek may also move out of the creek into the Verde River and disperse downstream. Roundtail chub from the population in Fossil Creek may be displaced out of the habitat area above the fish barrier and be in the Verde River at the same time stocked rainbow trout could be present at the Verde-Fossil confluence. Larger roundtail chub and the stocked rainbow trout may use the same pools in the river. Rainbow trout will not persist in the mainstem Verde River due to high temperatures, but while they are present, there is a potential for competition and, if young-of-the-year chub are present, a potential for predation.

## CUMULATIVE EFFECTS

The stocking sites are all on Tonto National Forest lands; however, the lower end of West Clear Creek is privately owned, with residential, commercial, and other activities in the area. Existing water rights dry up the creek during the agricultural irrigation season. In the portion of the land within the action area managed by the Forest Service, most activities that could potentially affect these species are Federal activities and subject to additional section 7 consultation. We are not aware of any additional development on the private lands along the creek that could result in changes to conditions for roundtail chub in the lower reaches.

Use of live bait fish is illegal in the West Clear Creek stocking area but is legal for the mainstem Verde River at the confluence with West Clear Creek. Fathead minnow, threadfin shad, mosquitofish, red shiner, and sunfish are legal for use in the river. Use of nonnative tiger salamanders as bait is also legal. No use of live bait of any kind to fish for stocked rainbow trout is expected, but bait species may be brought into the lower creek reach to fish for smallmouth bass.

*Middle Verde River***Description of the action area**

The action area extends on the mainstem from the Pecks Lake Diversion Dam to Horseshoe Reservoir, as this is the potential area of dispersal of these fish during the winter months. The action area in the two tributaries extends from their confluences with the Verde River to their headwaters. Rainbow trout stocked into the tributaries may move into the mainstem Verde River and disperse downstream. Stocked trout may persist in the middle Verde reach until at least August (Bonar et al. 2004) depending on local water temperatures. It is unlikely; however, that rainbow trout stocked during the summer would be able to survive in the river below West Clear Creek.

**A. Status of the species within the action area**

Roundtail chub inhabit the mainstem Verde River, Oak Creek, and Wet Beaver Creeks within the stocking areas. Historically, it is likely that the roundtail chubs in these connected waters were intermixing and comprised one unit since the waters were perennially connected, and the recent genetic studies support this concept. The Verde River occupied area is termed “stable-threatened” while the two tributaries are “unstable-threatened.” Roundtree Canyon is the new occupied site in the drainage, established using Verde River broodstock. As noted in the rangewide status, the mainstem Verde River is fragmented by dams, and the particular area where the roundtail chub population is “stable-threatened” may not include the entire reach of the river. As discussed for the upper Verde River, the roundtail chub occupied area there (which until the construction of the Pecks Lake Diversion Dam was perennially connected to the middle Verde River reach), has undergone significant declines (Voeltz 2002) although recruitment in 2005 did improve the status there. Voeltz (2002) also noted that the most robust population of roundtail chub was in the lower Verde River (from Bartlett Dam to the confluence with the Salt River), which is isolated from the middle Verde River by two large dams. Little was said in Voeltz (2002) about the roundtail chub population between the upper and lower reaches. Jahrke and Clark (1999) observed that roundtail chub had become rare from Childs to Horseshoe Reservoir, and a series of subsequent surveys up through 2009 by AGFD have not documented roundtail chub in this reach. The genetic information indicates that all roundtail chub in the Verde and lower Salt formed one unit and this area is considered a SCU. Brouder et al. (2000), based on population estimates, determined that nonnative species were likely suppressing roundtail chub populations in two areas of the upper Verde River. Bonar et al. (2004) did not detect many roundtail chub in the middle Verde reach, and nonnative predators were abundant. Ziebell and Roy (1989) specifically looked for roundtail chub above and in the middle Verde River stocking reach. Of the roundtail chub captured, 89 percent were above the Pecks Lake Diversion Dam. Whether this was a factor of the robust nonnative fish community in the stocking reach, or a lack of the pool habitat preferred by roundtail chub resulting from changes to habitat conditions from water diversions in the stocking reach is unclear, and the authors recommended further evaluation of habitat. Smallmouth bass were an important part of the fishery in the study area.

Kubacki (1998) captured 35 adult and 19 juvenile roundtail chub in the stocking reach by

electrofishing from October 1995 through August 1996. Roundtail chub numbers were considerably higher in the area above the stocking reach and above the diversion dam. At that point in time, the major predators (smallmouth bass, largemouth bass, and channel catfish) were present, and were more abundant in the areas above the stocking reach.

Clark (2003) surveyed the stocking reach of the middle Verde in June, 2003, and detected 68 roundtail chub; two large adults and 64 YOY. The adults were in pools and the YOY were in shallow riffles. Chmiel (2006) repeated Clark's survey in July, 2006. He detected five adult roundtails; one upstream of Oak Creek, one near the West Clear Creek confluence, and three above Beasley Flats. The areas where roundtail chub were found were similar between these two studies.

In summary, the roundtail chub population in the mainstem Verde River in the stocking reach is likely small and may not qualify as "stable-threatened." The two adult roundtail chub captured in 2003 were larger (400-500 mm) than the five in 2006 (200-249 mm). The 2003 adults were probably old adults that were likely at the end of their seven year lifespan. The smaller fish from 2006 were in the same size range so were likely the same age. Brouder et al. (2000) back-calculated size at age one through seven based on annular ring formation in scales of roundtail chub from the upper Verde River and lower West Clear Creek. Based on those data, three-year old roundtail chub would be approximately 248 mm; which implies that the YOY found in 2003 are likely the same cohort as reported in 2006. The declines in population since the 1980s and 1990s to 2006, and the limited recruitment, indicate this segment of the population should be considered as "unstable-threatened."

## **B. Factors affecting the species' environment within the action area**

As noted in Table 30, roundtail chub in the action area are affected by a number of land uses, particularly water withdrawals through the middle Verde reach. As discussed above, nonnative fish species are a continuing concern, as is the presence of crayfish and bullfrogs which are also predators on native fish such as roundtail chub.

## **EFFECTS OF THE ACTION**

Stocking of rainbow trout into the middle Verde River during the spring period when roundtail chub are spawning provides opportunities for predation on YOY chub and competition for pool habitats. There are few surveys of the Verde River during the period when stocked rainbow trout are most likely to be present so we do not have information on their dispersal to the lower portions of the stocking reach. However, at least two of the stocking sites (Bignotti and White Bridge) are close enough to where roundtail chub were taken in 2003 and 2006 that the stockings may be in what remains of occupied habitat. The timing of stocking also overlaps with the spawning period for roundtail chub. Available pool habitats are likely to be shared by both species. While the YOY in 2003 were captured in riffles, which is not their preferred habitat (summarized in Voeltz 2002), they are more likely to be in low-velocity waters in the water column or in shoreline drift where they would be vulnerable to predation by rainbow trout. Bonar et al. (2004) suggested that at higher densities, rainbow trout could have an impact on native-fish recruitment through predation if they were stocked during native-fish spawning



periods. While we do not know if the stocking rate for the middle Verde River (approximately 6,000 fish per stocking distributed irregularly between the five stocking sites) is sufficient to have an effect, they are an additive stressor on top of the existing nonnative predatory fish community, particularly in the early part of the spawning season when water temperatures are lower and the warmwater fish community may not be as actively feeding. Bryan and Hyatt (2004) recommended that the introduction of rainbow trout into the lower Salt River be evaluated for its effect on the roundtail chub, and that recommendation may be appropriate to consider for this site.

Another concern is angler bycatch. Roundtail chub are a legal sportfish in Arizona, with a limit of one fish over 13 inches (330 mm) per day. Both Ziebell and Roy (1989) and Kubacki (1998) included information on angler catch of roundtail chub. Kubacki (1998) noted that roundtail chub were the fourth most-creeled fish in 1997 and the second most in 1998. This was in the winter months, as Kubacki was evaluating the trout stocking program proposed for continuation under the proposed action. Ziebell and Roy (1989) in their creel information reported that anglers kept 60 percent of their catch. The most likely kept species would be rainbow trout and smallmouth bass, so it is uncertain how many roundtail chub were not returned to the water. Roundtail chub were not highly sought by anglers during the 1980s and 1990s, and some percentage of the catch may have been disposed of as trash fish by those who captured them inadvertently. Ziebell and Roy (1989) reported that when asked, 34 percent of anglers were fishing for roundtail chub and 47 percent said they had in the past captured roundtail chub. Of the eight roundtail chub taken, only three were kept. Creel data reported by Kubacki (1998) showed most roundtail chub were taken in the uppermost portion of the stocking area in 1996 (eight of 11) and in the lowermost two sites in 1997 (20 of 22). He also extrapolated the creel data to estimate total fish caught, with 351 and 850 roundtail chub estimated to be taken. He did not report the percentage of anglers who kept their catch. Brouder et al. (2000) and Brouder et al. (2002) stated that the current fishing regulations do not have a severe negative impact on the roundtail chub in the Verde River.

Even roundtail chub released back into the water are at risk of mortality from the stress of handling and injuries caused by hooking. The percentage of any hooked and released fish dying will vary due to a number of factors including how it was handled, how long it was out of the water, severity of hooking, and subsequent removal of the hook. Fishing with barbless hooks likely reduces hooking mortality; however, it is more likely that the anglers pursuing stocked rainbow trout are using barbed hooks. There is considerable literature on this topic, and no definable consensus. Knowledgeable anglers are more likely to return a roundtail chub to the stream in a safer manner than those with less information on native species and the regulations on their catch. The amount of angler bycatch of roundtail chub is unknown and may not be a significant issue.

## CUMULATIVE EFFECTS

The Verde River through the action area is a mix of National Forest, Tribal, state, and private lands. Activities on the watershed affect inflows and urban development is an increasing concern. Water diversions have significant impacts to habitats within the stocking reach, and groundwater use may continue to deplete flows. Most of the activities causing significant effects

are not on Federal lands, and the application of section 7 to those activities is limited to those actions with the involvement of an agency other than the Forest Service.

The nonnative fish population in the Verde River is well established and, based on available data, has expanded over the last 30 years, particularly in those areas where roundtail chub were formerly more abundant. These nonnative predators have significant adverse effects to roundtail chub.

Use of live bait fish is legal in the stocking reach. Use of nonnative tiger salamanders as bait is also legal. No use of live bait of any kind to fish for stocked rainbow trout is expected, but bait species may be used to fish for smallmouth bass.

### *Oak Creek*

#### **Description of the action area**

The stocking reach for Oak Creek extends from the switchbacks on Highway 89A down to Page Springs Hatchery. The action area extends from the top of the stocking reach to the confluence with the Verde River. This represents the potential dispersal area for rainbow trout.

#### **A. Status of the species within the action area**

The status of the roundtail chub population in Oak Creek is “unstable-threatened” and recent captures of the species are very rare. Historical records compiled in Voeltz (2002) indicate that all captures from 1936-2001 were below Grasshopper Point and most were in the lower most portions of the creek. Other AGFD survey data are concentrated in the upper portion of Oak Creek, with some reports from below Sedona, and no roundtail chubs were reported in those surveys. Three roundtail chub were reported from near the Highway 179 Bridge in Sedona in 2001. Two were in the possession of an angler and were released. Surveys by Rinker (2007) through the stocking area did not record any roundtail chub; however, only 10 sites were surveyed so there may be a small population still present. The Rinker survey did document both species of native sucker still present in the creek in the area most likely to be occupied by roundtail chub, as are speckled dace.

#### **B. Factors affecting the species’ environment within the action area**

As noted in Table 30, roundtail chub in the action area are affected by a number of land uses, particularly groundwater pumping and urban development. Recreational use of the creek is high, with a number of Forest Service and state recreational sites. Nonnative fish species are a continuing concern, as is the presence of crayfish and bullfrogs which are also predators on native fish such as roundtail chub.

### **EFFECTS OF THE ACTION**

The proposed action would stock rainbow trout during the spawning season for roundtail chub. At least the portion of the stocking reach from Sedona to Page Springs Hatchery may have a

small population of roundtail chub, as this is the area where all known reports occurred. Competition for space in pools immediately after stocking may occur when rainbow trout are at their highest densities. This also increases the opportunity for predation on YOY roundtail chub.

Angler bycatch may also be an issue for this site, as two of the last three reported roundtail chub were in possession of an angler. As discussed for the middle Verde River site, the effects to hooked fish are uncertain. Oak Creek is a heavily used fishing area during the stocking period, and the potential for take of roundtail chub cannot be discounted. They are, as noted earlier, a legal game fish at over 13 inches. Capture of smaller individuals requires them to be returned to the water, but survival rates of returned fish are not known.

## CUMULATIVE EFFECTS

The action area includes Coconino National Forest lands, some state land, and significant areas of private lands around Sedona and Cornville. Activities on the watershed affect inflows, and urban development is an increasing concern. Water diversions have significant impacts to habitats within the stocking reach, and groundwater use may continue to deplete flows. Most of the activities causing significant effects are not on Federal lands, and the application of section 7 to those activities is limited to those actions with the involvement of an agency other than the Forest Service.

Use of live bait fish is illegal in the stocking reach. Use of nonnative tiger salamanders as bait is legal. No use of live bait of any kind to fish for stocked rainbow trout is expected, but tiger salamanders may be used to fish for smallmouth bass.

### *Wet Beaver Creek*

#### **Description of the action area**

The stocking site is upstream of the confluence with the Verde River, from approximately the Beaver Creek Ranger Station to the U.S. Geological Survey stream gage. The weir for the gage acts as a barrier to upstream movement of fish.

#### **A. Status of the species within the action area**

The status of the roundtail chub population in Wet Beaver Creek is “unstable-threatened” and most recent survey data indicate a very low population that may be supported by roundtail chub dispersing downstream from above the gaging station weir. Barrett and Maughn (1995) found only adult roundtail chub below the weir. Surveys by AGFD in 1998 found roundtail chub above the gage station and a waterfall in the canyon-bound sections in the Wet Beaver Creek Wilderness. Brown trout and desert sucker were also found there, with smallmouth bass found below the waterfall and increasingly abundant downstream to the gage station and below. The expansion of smallmouth bass in the section of Wet Beaver Creek has created conditions where recruitment of roundtail chub is extremely limited, as indicated by only adults found in the stocking reach.

**B. Factors affecting the species' environment within the action area**

Smallmouth bass were stocked into Wet Beaver Creek in 1941 and established in the creek up to the gage-station weir. They dominated the fish community by 1985 (Reger 1985). Smallmouth bass were likely illegally moved above the weir (Barrett 1992) into the area that supported roundtail chub. With limited land use effects on this upper portion of Wet Beaver Creek, the primary factor affecting roundtail chub is the smallmouth bass.

**EFFECTS OF THE ACTION**

The stocking of rainbow trout below the weir adds another potential predator to the system during the period when roundtail chub are spawning. The number of roundtail chub below the weir is likely to be small, and likely is supported by individuals moving from above the weir and not local recruitment. Rainbow trout, like roundtail chub and smallmouth bass, are also pool dwellers, so post-stocking competition for space and food may also be occurring.

**CUMULATIVE EFFECTS**

The action area includes Coconino National Forest lands with a section of private land upstream of the ranger station. Activities on the watershed affect inflows and stream conditions. Most of the activities causing significant effects are on Federal lands, so they undergo section 7 consultations.

Use of live bait fish is illegal in the stocking reach. Use of nonnative tiger salamanders as bait is legal. No use of live bait of any kind to fish for stocked rainbow trout is expected, but tiger salamanders may be used to fish for smallmouth bass.

**BILL WILLIAMS RIVER**

Stocking sites in the Bill Williams River basin are small tanks set on several tributaries to the river and are divided into two complexes; Santa Maria and Burro Creek. Because stocking in the complexes potentially affects different roundtail chub populations, they are examined separately.

*Santa Maria River***Description of the action area**

This complex contains four stocking sites; Granite Creek #1 and #2, Bass Tank, and Blue Tank. Bass and Blue Tanks are on Loco Creek, a tributary to Sycamore Creek, and the Granite Creek tanks are in Little Shipp Wash drainage, a tributary to the Santa Maria River. The Sycamore and Kirkland creeks confluence is where the Santa Maria River forms. The action area is defined as the Loco Creek and Sycamore Creek down to the Kirkland Creek confluence, the lower portion of Kirkland Creek, the Santa Maria River down to the Highway 93 bridge crossing; and the Little Shipp Wash drainage down to the Santa Maria River.

**A. Status of the species within the action area**

The roundtail chub populations in Kirkland Creek, Sycamore Creek, and the Santa Maria River are all “unstable-threatened” with little survey history available. Occupied habitats in the Santa Maria River are in the vicinity of the Highway 96 bridge crossing, which is also where Little Shipp Wash meets the river. Occupied habitats in Sycamore Creek are above its confluence with Kirkland Creek, which is below the confluence with Loco Creek. Surveys in 1999 indicated that roundtail chub were locally common in Sycamore Creek, absent in Kirkland Creek, and uncommon in the Santa Maria River where Kepner (1980) had reported them common. Cummins (2009) did not report any roundtail chub from the Santa Maria River but did find other native species and green sunfish and fathead minnow above the Highway 96 bridge.

#### **B. Factors affecting the species’ environment within the action area**

The Santa Maria River drainage is largely supported by precipitation events, and much of the system is intermittent with permanent water in isolated reaches. Drought is a continuing issue for this system, as is groundwater pumping that depletes the shallow aquifer. Additional pumping in the eastern portion of the drainage may affect more areas. Deep pools can hold over the summer and provide most of the aquatic habitat available in some stretches, while shallow riffles and runs are elsewhere but do not comprise good roundtail chub habitat. Fresques et al. (1997) returned to many sites in the drainage previously visited by Kepner (1980) and documented increases in nonnative fish species, particularly red shiner, mosquitofish, yellow bullhead, and fathead minnow. Green sunfish are also present in the system. Fresques et al. (1997) noted that roundtail chub were reduced in the system, but were still “thriving” in some areas and cautioned that additional work was needed to establish if recruitment was sufficient to maintain the populations.

#### **EFFECTS OF THE ACTION**

The species proposed for stocking into the tanks are not established in the Santa Maria River or Sycamore and Kirkland creeks. There is only one record for bluegill. Redear sunfish are not currently in the system. The original stocking sites for the nonnative species that are present is likely the various stock tanks in the drainage that were privately stocked with various warmwater fish and bait species. Conditions above the Highway 96 bridge may be more conducive to nonnative fish establishment (Cummins 2009) than below the bridge; however, additional surveys are needed to document the extent of the nonnative populations.

Only bluegill and redear sunfish would be stocked into Bass and Blue tanks. Largemouth bass were stocked in the past into both tanks, and are only documented in Blue Tank at this time. These drain to Sycamore Creek into what is roundtail chub habitat. These tanks are not known to spill, but if they do, bass could move into Sycamore Creek and interact with roundtail chub in pools. This may have happened in the past, but no population of largemouth bass was established and under the proposed action, no new stockings of largemouth bass would be made, so if they disappear from Blue Tank, they would not be replaced. Bluegill is also a potential predator on small roundtail chub and have also been in the watershed tanks for many years but not established in the flowing water areas. Redear sunfish are less piscivorous but this stocking action would introduce a new species to the watershed in tanks that are not completely isolated

from the system. Introduction of new species into the drainage was discouraged by Fresques et al. (1997).

Granite Mountain #1 and #2 would only be stocked with bluegill and redear sunfish. These tanks do not contain largemouth bass. With the small watersheds for each, these tanks are not known to spill. Effects from stocking bluegill and redear sunfish in these sites are limited

## CUMULATIVE EFFECTS

Much of the action area is on state and private lands. Continuing development of these lands is likely to increase pressure on groundwater supplies that support the available aquatic habitats.

Use of live bait is illegal in the watershed, but tiger salamanders are legal. Past private stocking efforts have established a number of nonnative species across the watersheds that are expected to persist.

### *Burro Creek*

#### **Description of the action area**

The Burro Creek complex contains 10 stocking sites, one of which is a closed system (Coors Lake) and nine are small stock tanks that drain towards one of four roundtail chub streams (Burro Creek, Conger Creek, Francis Creek, and Boulder Creek). These streams are all connected, so we define the action area is the Burro Creek drainage from the headwaters to the Highway 93 bridge crossing.

#### **A. Status of the species within the action area**

There is limited survey information for the Burro Creek drainage, and most of the recent surveys are “spot-checks” or other limited efforts. Morgan et al. (1997) is the most comprehensive but was unable to repeat Kepner (1980) for portions of the drainage.

The roundtail chub populations in Boulder Creek and Conger Creek are considered “stable-threatened” and those in Burro Creek and Francis Creek are “unstable-threatened.” In Voeltz (2002), Francis Creek was considered “stable-threatened” based on Morgan et al. (1997) reporting of a dominant native fish community with multiple age classes of roundtail chub. Subsequent monitoring (Fong 2004a) did not find any roundtail chub but did find green sunfish and both yellow and black bullheads. This information supported the shift to “unstable-threatened” for Francis Creek. Conger Creek was considered “unknown” in Voeltz (2002). Surveys reported in Clark (2003) and Fong (2004b) documented a good population of roundtail chub with recruitment in Conger Creek with no nonnatives reported. Conger Creek was then considered to be “stable-threatened.” The more recent information for Boulder Creek is Chmiel and Cummins (2007) which was a visual survey of a portion of the creek. No fish except for a few fry were seen. AGFD (2009) reported finding six roundtail chub in Boulder Creek. Upper Burro Creek was “spot checked” in 2004 with roundtail chub of at least two size classes reported and no nonnatives seen. This location, while not clearly defined, appears to be perhaps two or

three miles below the confluence of Pine Canyon and Burro Creek (Fong 2004b). In 2007, Cummins and White (2007) did brief surveys of Burro Creek 3.5 miles upstream from the Francis Creek confluence and visually observed two large roundtail chub along with green sunfish dominating pool habitats and yellow bullhead also observed. They also commented that this reach of the creek could be managed for native fish, and that stock tanks in the watershed should be evaluated for escapement potential for nonnative fish as part of that management option.

## **B. Factors affecting the species' environment within the action area**

Aquatic habitat in the Burro Creek drainage is threatened by surface and groundwater diversions, potential contamination by mine tailings, livestock grazing, recreation, and the presence of nonnative fish species (USFWS 2010). Flows in the drainage are largely supported by precipitation, with areas of perennial water often isolated from each other by several miles of ephemeral or intermittent channels. Drought is a continuing issue for the drainage.

### **EFFECTS OF THE ACTION**

Stocking sites in the Pine Creek sub-drainage to upper Burro Creek (Antelope Tank, Bar 37 Tank, Carter Tank, and Harmon #2) would be stocked with bluegill and redear sunfish. Pine Creek enters Burro Creek in the upper area that Cummins et al. (2007) had noted the potential for native fish restoration. These four tanks rarely spill, and the watershed is ephemeral in the headwaters and intermittent to the confluence with Burro Creek, and fish may persist for a short time behind Pine Creek Dam. There are no surveys in Pine Creek; however, outside of the small pool above the dam, there is no permanent water. While it is possible for fish stocked into the four tanks in the drainage to be displaced to Burro Creek, the risk is small and these sunfish species are unlikely to establish in the system or have significant effects to roundtail chub. Further, there is an 80-foot waterfall with no plunge pool on Pine Creek above the confluence with Burro Creek that likely reduces the survivability of any fish moving downstream in a flood event.

Stocking in the Conger Creek drainage is at Little Antelope Tank, which is on an ephemeral tributary. Only bluegill and redear sunfish are proposed for stocking although largemouth bass are present in the tank from previous stockings. Should the largemouth bass disappear from the tank, they would not be restocked. The tank is in the ephemeral headwaters of the creek with a low risk of spilling. However, there is another tank two miles downstream near the confluence with Conger Creek that may act as a refuge for any fish escaping Little Antelope Tank. Conger Creek is ephemeral/intermittent for 6.5 miles below the confluence, then perennial for three miles. No nonnative species were documented in Conger Creek in the most recent survey; with green sunfish only found once in 1998. This creek may be the only site in the drainage where nonnative species are not present, and there is a concern for potential contamination from upstream; however, it is unlikely that bluegill or redear sunfish would establish in this stream. Conger Creek is ephemeral at the confluence with Burro Creek, and nonnative species are present there, but apparently have not been able to move upstream to establish populations.

Swale Tank is on an ephemeral tributary to Francis Creek and last spilled in 2004. Bluegill and

redeer sunfish are proposed for stocking under the proposed action. Channel catfish were previously stocked, but are not part of the proposed action.. No surveys have been done of the tank since 1996, and it went dry in 2003 so the community that was present is unknown. If channel catfish were still present and subsequently disappeared, they would not be restocked. Flows from Swale Tank enter Francis Creek in an intermittent stretch, and it is approximately nine miles upstream of the perennial habitat at the lower end of Francis Creek. Roundtail chub were known from Francis Creek near the inflow from the small drainage containing Swale Tank. Channel catfish or the currently proposed species have not been reported in Francis Creek, or in Burro Creek near their confluence. Morgan et al. (1997) did document black bullhead and green sunfish present at that site along with roundtail chub. Fong (2004a) did find both yellow and black bullheads at and below the area surveyed during the 1990s. Stocking bluegill and redear sunfish in place of channel catfish into Swale Tank reduces the threat of channel catfish accessing the roundtail chub population. The status of this population declined between 2002 and 2009, and nonnative fish populations appear to have expanded at least in the lower portion of the creek where all recent surveys were completed. Neither bluegill nor redear sunfish would be expected to establish a population in Francis Creek.

Harmon, McElhaney, and Stubbs tanks are in the headwaters of Boulder Creek. Channel catfish and largemouth bass were historically stocked into these tanks but are not part of the proposed action and if they disappear from these tanks, would not be restocked. Only bluegill and redear sunfish are proposed for stocking under the proposed action. All known survey locations for roundtail chub are in the vicinity of its confluence with Wilder Creek or nearer the confluence with Burro Creek. All three tanks spilled in 2004 and likely connected to the occupied habitats for roundtail chub. No stocked fish species have been identified in the occupied reach of Boulder Creek; however, except for a one day trip in 2008, no surveys have been done since the last spill event in 2004. It is not expected that bluegill or redear sunfish would establish populations in Boulder Creek.

## CUMULATIVE EFFECTS

Much of the action area is on state and private lands with some Bureau of Land Management land at the lower end of the creek. Continuing development of private or state lands is likely to increase pressure on groundwater supplies that support the available aquatic habitats.

Use of live bait fish is illegal in the watershed, but tiger salamanders are legal. Past private stocking efforts have established a number of nonnative species across the watersheds that are expected to persist.

## SUMMARY OF EFFECTS

Of the 31 extant waters occupied by roundtail chub, the proposed action would affect 17; five “stable-threatened,” 11 “unstable-threatened,” and one “unknown.” Within Management Area A, four occupied waters in the Salt River and four occupied waters in the Verde River are affected. Within Management Area B, seven occupied waters may be affected if stocked sportfish exit the stocking sites, and within Management Area C, two occupied waters may be affected if stocked sportfish exit the stocking sites. The significance of the potential effects



varies between populations based on the species to be stocked (and if they are already established in the stocking reach), proximity of the stocking site to occupied roundtail chub habitat, seasonality of the effect (exposure during the roundtail chub spawning period), and the status of the affected roundtail chub SCU.

Nonnative fish species are established in all but one of the extant populations; Fossil Creek (and possibly Conger Creek, however, there are no barriers to prevent nonnatives from entering this creek). Depending on the location, warmwater and/or coldwater sportfish, bait fish species, and other nonnatives are present and most of those populations are likely self-sustaining. Stocking actions that affect roundtail chub populations can augment an existing population; establish the stocked species for a limited time period; or provide a source of nonnative predators that while they may not establish in the occupied roundtail chub habitat, can persist there for a long period.

Contributing to the difficulty of assessing the significance of a particular sportfish stocking action on roundtail chub is the limited amount of survey data that supports the status determinations made in the 12-month finding (USFWS 2009). In-depth monitoring is not available for most of these populations, and what is available is usually limited in time or areal scope. Further, in the case of the Verde River (determined to “unstable-threatened” by Voeltz (2002) but “stable-threatened” in the 12-month finding in 2009, based on additional survey data that was mentioned by Cantrell (2009) the status of the roundtail chub from the headwaters down to the Salt River confluence is not consistent. The upper Verde and the lower Verde (below Bartlett Dam) can perhaps be considered “stable-threatened” but the section through the middle Verde does not appear to be, and roundtail are very rare from Childs to Horseshoe Reservoir. The status of the Salt River mainstem population is also not consistent, with portions of the upper Salt River clearly “unstable-threatened” while others, including the Black River, being stable-threatened, and the lower Salt River perhaps only recently falling to that level. Evaluating effects of stocking actions within the different reaches must take this into account.

### Management Area A

Direct effects of the proposed action would not be felt in the Gila River portion of this management area. The “stable-threatened” population in Aravaipa Creek is probably the most robust remaining population with the exception of Fossil Creek. Significant efforts to protect native fish in Aravaipa Creek are ongoing; however, roundtail chub is not a targeted species for those efforts and the resultant benefits are incidental but count to the conservation of the species.

In the Salt River portion, direct effects of the proposed action would be felt in the lower Salt River, Black River, Salome Creek, and possibly Canyon Creek. The population of most concern is the lower Salt River, where rainbow trout are stocked into occupied roundtail chub habitat during the spawning season. Trout stocked into the Black River and Workman Creek would have to disperse from the stocking sites to occupied roundtail chub habitat. Trout are established in the Black River, and it is unlikely that the stocked fish are supporting the wild populations and future stockings of triploid trout would preclude that from happening in the future. Workman Creek may have a small recruiting population of rainbow trout that supports that found in Salome Creek; however, that rainbow trout can persist all year in the occupied roundtail chub habitats of lower Salome Creek raises the level of concern in the event that trout are not self-

sustaining higher in the watershed. Roundtail chub in Canyon Creek may or may not be located high enough in the watershed to be exposed to stocked brown or rainbow trout. The status of the Canyon Creek population is “unknown” due to a lack of survey data available to us from the WMAT.

In the Verde River portion, direct effects of the proposed action would be felt in the upper and middle Verde River, Oak Creek, Wet Beaver Creek, and upper and lower West Clear Creek. The areas of most concern are the middle Verde, Oak Creek, Wet Beaver Creek, and lower West Clear Creek where stocking of rainbow trout is into occupied habitat during the spawning season. The upper Verde River is at less risk due to the need for the stocking reservoirs to spill before connectivity can be made, and the stocked species are less predaceous or would not persist into the spawning period. Upper West Clear Creek also is at less risk since Huffer Tank must spill for stocked trout to reach the creek, rainbow trout is already present and self-sustaining in the occupied habitat, and this portion of the roundtail chub population appears robust. No effects are expected to Fossil Creek from the proposed action. The lower Verde River portion of the population is unlikely to be affected by stocking in the Verde River; however, it may be affected by the lower Salt River and Salt River reservoir stockings particularly if some of the warmwater fish community is supported by outmigration from the reservoirs.

#### Management Area B

Of the 11 roundtail chub occupied waters in the Bill Williams River drainage, only Trout Creek is significantly isolated from the stocking sites in the Burro Creek and Santa Maria River drainages. Wilder Creek, a tributary to Boulder Creek, evinces some risk from nonnatives in Boulder Creek and additional surveys of the lower reaches are needed to understand if there is a barrier that prevents fish movement upstream. Burro Creek may be somewhat protected by an upstream waterfall on Pine Creek that reduces the risk of stocked fish in the Pine Creek drainage from successfully moving downstream. Conger, Boulder, and Francis creeks are more likely to have connectivity with stocking sites in the watershed, and this is perhaps more likely for the two “stable-threatened” populations than for Francis Creek. The four stocking sites above the three Santa Maria populations may be less likely to spill and allow dispersal of stocked species. The proposed action has stocking of only bluegill and redear sunfish into tanks in the Bill Williams River drainage. While past actions have also included channel catfish and largemouth bass, these species are no longer part of the proposed action. As these tanks dry or become otherwise compromised through natural events, these predaceous species would not be reestablished. Bluegill and redear sunfish are less likely to have effects on roundtail chub populations, and are unlikely to establish in the streams containing chubs. The proposed action reduces the long term risk from highly predaceous channel catfish and largemouth bass to roundtail populations in this management area since these species will no longer be stocked by AGFD.

#### Management Area C

Stocking into the Chevelon Creek complex can affect the roundtail chub population below Chevelon Canyon Lake. This habitat is limited, particularly in the summer, and rainbow trout dispersed from the lakes in the winter may persist through most of the roundtail chub spawning

season. Since most of the habitat is isolated pools, escaped rainbow trout would be in the occupied roundtail chub habitats if they survived to be stranded in the isolated pools. Effects to upper East Clear Creek from stocking into CC Cragin Reservoir and Knoll Lake are already mitigated by stocking restrictions and surveys. Rainbow trout in Clear Creek Reservoir may access occupied roundtail chub habitats upstream of the reservoir during the spawning season.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area Wide Analysis discusses this effect in more detail.

Disease and parasites are additional threats to roundtail chub populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm *Bothriocephalus acheilognathi*, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm (*Lernaea cyprinacea*) originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich (*Ichthyophirius multifiliis*) is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect roundtail chub. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

#### CONCLUSION

After reviewing the current status of roundtail chub, the environmental baseline for the action area, the effects of the proposed sportfish stocking program and the cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the roundtail chub. No critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on roundtail chub for the following reasons:

- The overall status of the roundtail chub is not clearly understood. Across Arizona, 31 of 40 historically known waters in five discreet major river basins still contain roundtail chub, and one is considered stable-secure. Determination of status categories was most recently done in 2009 for the 12-month finding; however, the supporting data are qualitative, non-standardized, and in some cases, very limited. While this is the best available information and it was used consistently across the sites, considerable unknowns remain about the status of the species in these occupied waters. Roundtail chub in these waters may be persisting at varying levels in the face of ongoing physical and biological threats, but a number of them are in small habitats where stochastic events may result in extirpation. The recent genetic data indicates that although many sites are isolated, the genome in the most at-risk sites on the Verde River is part of a connected population with considerable resilience as documented by recruitment events after spring floods. Despite these uncertainties, the overall status of the DPS does not point to extinction in the next 10-years.
- The proposed action may affect 17 of the 31 known waters occupied by roundtail chub, including five currently considered “stable-threatened” and 11 currently considered “unstable-threatened” in the 12-month finding (USFWS 2009). Rainbow trout are the only sportfish stocked into occupied roundtail chub habitats (six of the 17 affected waters), and an evaluation of the magnitude of the effect of these stockings on the roundtail chub present is complicated by the presence of wild populations of nonnative fish that are also more effective potential predators and competitors. At the other stocking sites, a mix of cold-and warmwater sportfish are proposed for stocking and the connectivity between stocking sites and occupied habitats is possible at varying levels of likelihood, so effects are not likely to occur often. The elimination of stocking channel catfish and largemouth bass in the stocking sites Bill Williams River drainage (excepting Coors Lake which is a closed system) provides additional protection from these species becoming established in the system.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline in the occupied waters. These effects are expected to continue at their present level over the 10-year period covered by this consultation, so there is no meaningful increase in effects.
- The conservation measure to only stock triploid rainbow trout will significantly reduce the likelihood that stocked rainbow trout would contribute to self-sustaining populations of rainbow trout in roundtail chub habitats.
- The implementation of the Statewide Conservation Agreement (AGFD 2006) has provided conservation actions for roundtail chub. Two new waters, Ash Creek and Roundtree Canyon were stocked with roundtail chub under the agreement and other actions are listed under the range-wide status of the species. Other conservation under the Gila River Basin Native Fishes Program has also benefitted roundtail chub.

- Significant conservation measures to improve the overall status of the roundtail chub are included in the conservation plan that will be implemented are part of the proposed action and these adequately offset the adverse effects of the proposed action.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### **AMOUNT OR EXTENT OF TAKE**

The prohibitions against taking roundtail chub found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for this species at this time. The proposed action, through the Conservation and Mitigation Program, is providing conservation measures directed to address potential take that may result from the proposed action. If and when the roundtail chub is proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement at that time.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We have not developed any additional conservation recommendations for the roundtail chub.

The final conservation plan developed for implementation as part of the proposed action contains the priority items for conservation of this species.

*Likely candidate species*<sup>9</sup>

### **Narrow headed Gartersnake (*Thamnophis rufipunctatus*)**

#### **DESCRIPTION OF THE PROPOSED ACTION**

The narrow headed gartersnake (NH gartersnake) is in the vicinity of sportfish stocking sites in the Black River, Canyon Creek, Granite Creek, Lower Verde River, Middle Verde River, San Francisco River, and Tonto Creek stocking complexes (Table 32). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. The degree of potential adverse effects to NH gartersnake from stocking sportfish in these areas varies and is described in the analyses for each complex.

Table 32: Stocking sites, sportfish species proposed for stocking, and potentially affected NH gartersnake populations.

| <b>Stocking complex/<br/>Sites</b> | <b>Species stocked</b>                    | <b>NH gartersnake population</b> |
|------------------------------------|-------------------------------------------|----------------------------------|
| <i>Black River</i>                 |                                           |                                  |
| Ackre Lake                         | ONAP, THAR                                | Black River                      |
| Big Lake                           | ONMY, SAFO, ONCL,<br>ONAP                 | Black River                      |
| Crescent Lake                      | ONMY, SAFO                                | Black River                      |
| East Fork Black River              | ONAP, ONMY*                               | Black River                      |
| West Fork Black River              | ONAP                                      | Black River                      |
| <i>Canyon Creek</i>                |                                           |                                  |
| Canyon Creek                       | ONMY, SATR                                | Canyon Creek                     |
| <i>Granite Creek</i>               |                                           |                                  |
| Goldwater Lake                     | ONMY, PONI, LEMA,<br>MISA                 | Middle Verde River               |
| Watson Lake                        | ONMY*, PONI, LEMA                         | Middle Verde River               |
| Willow Creek                       | ONMY*, PONI, LEMA                         | Middle Verde River               |
| <i>Lower Verde River</i>           |                                           |                                  |
| East Verde River                   | ONMY                                      | Middle Verde River               |
| Green Valley Lake                  | ONMY                                      | Middle Verde River               |
| <i>Middle Verde River</i>          |                                           |                                  |
| Deadhorse Ranch SP                 | ONMY, ICPU, LEMA*,<br>MISA*, PONI*, DOPE* | Middle Verde River               |
| Middle Verde                       | ONMY                                      | Middle Verde River               |

<sup>9</sup> The AESO believes these species may become candidates within the period covered by this consultation, and elected to include them in this analysis because of the potential for adverse effects to them from the proposed action, and that significant conservation for these species is also included in the proposed action.

|                            |            |                               |
|----------------------------|------------|-------------------------------|
| Oak Creek                  | ONMY       | Oak Creek, Middle Verde River |
| West Clear Creek           | ONMY       | Middle Verde River            |
| Wet Beaver Creek           | ONMY       | Middle Verde River            |
| <i>San Francisco River</i> |            |                               |
| Luna Lake                  | ONMY, ONCL | San Francisco near Reserve    |
| <i>Tonto Creek</i>         |            |                               |
| Christopher Creek          | ONMY       | Tonto Creek                   |
| Haigler Creek              | ONMY       | Tonto Creek                   |
| Tonto Creek                | ONMY       | Tonto Creek                   |

Conservation measures included in the proposed action.

Narrow-headed gartersnake is a priority species for conservation in the proposed action and as such, will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

AGFD commits to provide for two NH gartersnake populations either through securing existing but threatened populations or establishment of new conservation populations. The first population will be initiated within five years and the second population within seven years

In providing for two gartersnake populations either through securing existing but threatened populations or establishment of new conservation populations, a source for individuals to reestablish conservation populations is needed, as well as information on propagation, release options, and techniques for successfully securing existing threatened populations. Member organizations of the Gartersnake Conservation Working Group have initiated applied research in these arenas, and the AGFD shall contribute to these types of efforts during the 10-year program. Once sufficient information is obtained on techniques to reestablish populations and/or secure existing threatened populations, the AGFD shall initiate the population reestablishment and/or securing actions. Within two years the AGFD will develop a plan to support and/or implement research in these arenas. Supporting and/or implementing this research will then follow the plan. Within three years, AGFD shall develop outreach material on gartersnakes to attempt to reduce the deliberate killing or injuring of gartersnakes by the public. Materials developed for this program will be posted at stocking sites that contain populations of gartersnakes.

As part of all native fish reintroduction efforts in Arizona, AGFD shall ensure that renovated streams occupied by NH gartersnakes will be quickly restocked with appropriate native fish species and that can provide prey for NH gartersnakes so as to not put stress on any NH gartersnake population through elimination of its forage base. This measure will be implemented as needed.

Within three years, AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the AGFC for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper

disposal of live bait species.

Within three years, AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

The AGFD shall share information with, and periodically solicit available information from, the NMDGF to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and gartersnake populations in the San Francisco River drainage.

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

NH gartersnake is under consideration for candidate species status under the Act. A candidate assessment form is being prepared by our office for inclusion in the 2011 Candidate Notice of Review.

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the narrow-headed gartersnake. This information was taken from Rosen and Schwalbe (1988), the New Mexico Recovery Plan (Pierce 2007), Holycross et al. (2006), and Brennan and Rosen (2009). Information in these documents is incorporated by reference.

##### *Life history*

The narrow-headed gartersnake is surface-active generally between March and November (Nowak 2006). Little information on suitable temperatures for surface activity of the narrow-headed gartersnake exists, however it is presumed to be rather cold-tolerant based on its natural history and foraging behavior that often involves clear, cold streams at higher elevations. Along Oak Creek in Arizona, Nowak (2006) found the species to be active in air temperatures ranging from 52-89°F and water temperatures ranging from 54-72°F.

Narrow-headed gartersnakes are generally recognized to specialize on fish as their primary prey item (Rosen and Schwalbe 1988; Nowak 2006, Degenhardt et al. 1996, Rossmann et al. 1996). Native fish species most often associated as prey items for the narrow-headed gartersnake include Sonora sucker, desert sucker, speckled dace, roundtail chub, Gila chub, and headwater chub (Degenhardt et al. 1996, Rosen and Schwalbe 1988). Nonnative species used as prey by narrow-headed gartersnakes are most often salmonid species (trout); most commonly brown and rainbow trout as these species are commonly stocked or established in, or near, occupied narrow-headed gartersnake habitat (Rosen and Schwalbe 1988, Nowak 2006). Rarely, the narrow-headed gartersnake has been observed eating larval or metamorphosed amphibians (Degenhardt



et al. 1996, Rossman et al. 1996). Unlike many other species of gartersnakes that are active predators (actively crawl about in search of prey), narrow-headed gartersnakes are considered to be ambush predators (sit-and-wait method), often anchoring themselves at the bottom of streams, awaiting fish (Brennan and Holycross 2006, Pierce 2007).

Sexual maturity in narrow-headed gartersnakes occurs at 2.5 years of age in males and at two years of age in females (Degenhardt et al. 1996). Narrow-headed gartersnakes are ovoviviparous (eggs develop and hatch within the oviduct of the female). The reproductive cycle for narrow-headed gartersnakes appears to be longer than other gartersnake species; females begin the development of follicles in early March and gestation takes longer (Rosen and Schwalbe 1988). Female narrow-headed gartersnakes breed annually and give birth to 4-17 offspring from late July into early August (perhaps earlier at lower elevations (Rosen and Schwalbe 1988).

The life span of NH gartersnake in the wild is unknown; however, other similar species may live up to nine or ten years under suitable conditions. Survival past birth to reproductive age varies; the number of neonates that live to become adults was estimated for another gartersnake as 16 and 50 percent in two study groups. Adult survival is also variable, year-to-year survivorship in two populations of another gartersnake species was 34 and 67 percent. Based on demographic studies on the common gartersnake and making a conservative estimate on survivorship and fecundity rates without consideration of the presence or degree of threats, it is reasonable to presume that, on average, two individual NH gartersnake from each litter may reach reproductive age. Whether or not these individuals find a mate and successfully reproduce depends upon the population density and the degree of threats that may be acting on a given population.

### Habitat

The narrow-headed gartersnake is widely considered to be one of the most aquatic of the gartersnakes (Rossman et al. 1996). This species is strongly associated with clear, rocky streams using predominantly pool and riffle habitat that includes cobbles and boulders (Rosen and Schwalbe 1988, Degenhardt et al. 1996, Rossman et al. 1996). Rossman et al. (1996) also note the species has been observed using lake shoreline habitat in New Mexico. Narrow-headed gartersnakes occur at elevations from approximately 2,300 – 8,200 feet in elevation inhabiting Petran Montane Conifer Forest, Great Basin Conifer Woodland, Interior Chaparral, and the Arizona Upland subdivision of Sonoran Desertscrub communities (Rosen and Schwalbe 1988, Brennan and Holycross 2006, Burger 2008). Where narrow-headed gartersnakes are typically found in the water, little aquatic vegetation exists (Rosen and Schwalbe 1988). However, bank-line vegetation is an important component to suitable habitat for this species. Common plant species associations include Arizona alder (highest correlation), velvet ash, willows, canyon grape, blackberry, Arizona sycamore, Arizona black walnut, Fremont cottonwood, Gambel oak, and ponderosa pine (Rosen and Schwalbe 1988). Rosen and Schwalbe (1988) noted that the composition of bank-side plant species and canopy structure were less important to the species' needs than was the size class of the plant species present; narrow-headed gartersnakes prefer to use shrub- and sapling-sized plants for thermoregulating (basking) at the waters' edge (Degenhardt et al. 1996).

### Current distribution

NH gartersnake is only found in the United States in Arizona and New Mexico, ranging across the Mogollon Rim and along its associated perennial drainages from central and eastern Arizona, southeast to southwestern New Mexico (Wood et al. 2010). More specifically, the species was historically distributed in headwater streams of the Gila River watershed that drain the Mogollon Rim and White Mountains in Arizona, and the Gila Wilderness in New Mexico; major sub-watersheds in its historical distribution included the Salt, Verde, and Gila sub-watersheds (Holycross et al. 2006). Holycross et al. (2006) suspect the species was likely not historically present in the lowest reaches of the Salt, Verde, and Gila rivers, even where perennial flow persists.

Several sites in Arizona were targeted for surveys by Holycross et al. (2006) within the general distribution of narrow-headed gartersnakes and appeared to offer suitable habitat, but lacked historical records for the species. Some of these sites are within a reasonable dispersal distance from sites with historical records; others, not reasonably so. Holycross et al. (2006) is perhaps the most current and thorough assessment of the status and distribution of the narrow-headed gartersnake in Arizona (with limited surveys in the San Francisco River near Glenwood, New Mexico). Within Arizona, the narrow-headed gartersnake is likely extant at sites within the following watersheds: Verde River (Verde River mainstem from Perkinsville, Arizona downstream to the confluence with Fossil Creek); Oak Creek from Pumphouse Wash downstream to Grasshopper Point/Midgely Bridge), Salt River (Black River below Wildcat Point; Tonto Creek between the Houston Creek and Gun Creek confluences), and Gila River (Blue River). Status is unknown at several sites in the Gila River, Salt River (including upper Tonto Creek and other tributaries), and Verde River drainages. More specific distributional data will be provided as part of the environmental baseline sections.

According to Holycross et al. (2006), the narrow-headed gartersnake is likely extirpated from at least five sites in Arizona and one site in New Mexico where it was recently common: 1) in the Verde River watershed, they were common through the 1980's at one site in the East Verde River and now likely extirpated; 2) in the Upper Gila River watershed, they were common at two sites each in the San Francisco River and Eagle Creek through the 1990's where the species appears to be likely extirpated; and 3) in the Salt River watershed where the species appears to be likely extirpated from one site, the East Fork Black River at Diamond Rock.

Within New Mexico, the narrow-headed gartersnake is likely extant at sites within the following watersheds: Gila River (lower portions of the West and Middle Forks of the Gila River near Cliff Dwellings; Gilita Creek between the confluences of Willow Creek and Snow Creek; mainstem Gila River from Cliff Dwellings to Little Creek; Little Creek below the fish barrier; Gila Bird Area south of Cliff and upstream of the Middle Box), East Fork Gila River (Black Canyon up- and downstream of fish barrier; mainstem East Fork Gila River downstream of Trails End Ranch; lower Diamond Creek downstream of Lynx Ranch), and San Francisco River (Whitewater Creek at the vicinity of Glenwood; lower mainstem of San Francisco River downstream of Alma Bridge; upper mainstem of San Francisco River near the Box, north of Reserve; Tularosa River from the native fish sampling site (Paroz et al 2006) upstream to Hells Hole; mainstem and South Fork of Negrito Creek).

## Threats

The draft candidate assessment form details the threats to NH gartersnake including loss of habitats due to groundwater pumping, water diversions, elimination of riparian areas due to improper watershed uses including improper livestock management, urban development including roads, and other factors. This discussion focuses on those threats of relevance to the evaluation of the proposed action.

The introduction of nonnative invertebrates, amphibians, and fishes to Arizona has significant effects to NH gartersnake in the form of predation and competition (particularly predation on neonates and juveniles by crayfish, centrarchids (largemouth bass, smallmouth bass), catfish, and bullfrogs) that affects recruitment, and, perhaps more significantly, alterations to their prey base from nonnative species preying on native fish. NH gartersnake are predators with small native fish the primary component of their diet. Distribution and population size native fish species has significantly been altered by the introduction of the nonnative species, to the extent that they are no longer widespread across watersheds. Predation, competition, and disease and parasite introductions are factors in the decline of the native fauna. Remnant populations of Gila chub, roundtail chub, native suckers, and dace species that once supported NH gartersnake are scattered across the landscape. Nonnative species occupy much of the remaining aquatic habitats and, with the exception of small trout, are of lesser value to NH gartersnake as prey items. For example, spiny-rayed fishes such as the centrarchids are difficult to ingest without injury due to the dorsal spines. Without a robust prey base, neonate and juvenile NH gartersnake may not be able to find sufficient food to support growth and adult NH gartersnake may produce fewer and less viable young due to poor health.

NH gartersnake are also at risk from intentional harm from people afraid of snakes in general. Mortality of NH gartersnake on Oak Creek has been documented, and intentional killing may have been a factor in the extirpation of the East Fork Black River since it was located in the vicinity of a section of the river heavily used for recreation. These observations of intentional killing of snakes have caused land managers to post signs in high- visitation areas informing people to leave these gartersnakes alone because they are not harmful.

## Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active participant in implementation of conservation actions for the NH gartersnake.

Ongoing conservation actions for NH gartersnake are undertaken by the Gartersnake Conservation Working Group (GCWG) include monitoring, telemetry studies, captive propagation projects, and conservation planning for future reintroductions (GCWG 2008)

## *Previous consultations*

The narrow-headed gartersnake is not yet a listed or candidate species and has not been considered in section 7 consultations.

## ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

### **Description of the Action Area**

NH gartersnake are potentially affected by sportfish stocking actions in several disjunct drainages. The different drainages are discussed individually below. Drainages where effects to NH gartersnake are more limited are discussed first.

#### Stocking locations with limited effects to NH gartersnake or prey base

##### *Black River Complex*

Four of the five Black River complex sites are located in the headwater area of the Black River, with the fifth located below the confluence of the East and West Forks that creates the Black River proper. This area is historical habitat for NH gartersnake. Currently, the closest population in the mainstem Black River extends up to at least Point of Wildcat, about a mile below the Fish Creek confluence (site of the Ackre Lake stocking site). The status of this NH gartersnake population is declining (Brennan and Rosen 2009), and NH gartersnake is extirpated from historical sites in the East Fork Black River where it was present in reliable numbers through the 1980s. It is unlikely that a significant number of stocked trout from the upper four headwater sites would move downstream in the Black River to NH gartersnake habitat. The effects to that population from the stocked trout is limited by the distance the stocked fish need to travel, the mortality rate of these trout such that few survive to move out of the stocking reach that leads to few fish accessing the NH gartersnake habitat. Further, rainbow and Apache trout are not likely to persist in the warmer waters downstream, unlike the brown trout and smallmouth bass that dominate the nonnative fish fauna there.

Apache trout stocked into Ackre Lake in the head of the Fish Creek drainage can move out of the lake and into the creek, which also supports a recovery population of Apache trout. Movement of Apache trout from the Fish Creek recovery population into the Black River and then downstream into the NH gartersnake area is possible; Apache trout have been taken by anglers in this reach (Brennan and Rosen 2009). Whether those fish included stocked Apache trout is not possible to say, since there is a reproducing recovery population of Apache trout in Fish Creek.

The prey base in the Black River has been heavily impacted by nonnative species, particularly brown trout and smallmouth bass. Roundtail chub persist in the NH gartersnake habitat, but the status of the population is unknown. The 2011 Wallow Fire did not burn within what is believed to be occupied NH gartersnake habitat on the Black River, and post-fire runoff may have affected the prey base in the Black River. If smallmouth bass numbers are reduced in the

Black River, native prey species may be able to recover to levels appropriate to support the NH gartersnake.

#### *East Verde River Complex*

The East Verde River complex contains two stocking sites, one in the headwaters and one a man-made lake in the Town of Payson. NH gartersnake are found in the mainstem Verde River as far as the confluence with Fossil Creek, which is a few miles upstream of the East Verde River confluence. The Middle Verde population of NH gartersnake is of low density, and precise delineation of the end of occupied habitats is difficult and likely varies over time. Rainbow trout are stocked into the headwaters area during the summer and are unlikely to move downstream during this period in numbers that could affect NH gartersnake or their prey base. Rainbow trout would not persist in the lower East Verde or the Verde mainstem due to high summer water temperatures.

Due to extirpation of the historical NH gartersnake population from the upper East Verde River near Crackerjack Road (near the Highway 87 bridge), distance between the headwaters and Green Valley Lake stocking sites and the occupied sites on the Verde River, and the lack of significant effects from the movement of a low number of channel catfish into the Verde River, effects to NH gartersnake from stocking in these sites are limited.

#### *Tonto Creek Complex*

Tonto Creek complex contains three stocking sites in the headwaters of the drainage. NH gartersnake populations are located below these sites, from Houston Creek to Gun Creek. Historically, NH gartersnake were known from the Tonto Creek drainage above Houston Creek, and in Haigler Creek. The Haigler Creek population is believed to be extirpated, and the status of the population above Houston Creek is unknown. The known population is at low densities, with adults and neonates present but few intermediate sizes. Few stocked rainbow trout overwinter in the upper drainage to be displaced downstream during spring runoff; however, monsoon flood events occur during the stocking period and may displace rainbow trout downstream toward NH gartersnake habitat. In all surveys conducted below Hells Gate, only one rainbow trout was captured; near Gisela which is about a mile below Houston Creek's confluence with Tonto Creek. The time of year for that record is unknown. Water temperatures below Hells Gate in June may be warm enough to preclude rainbow trout survival. If this is correct, then temperatures further downstream where NH gartersnake are present are already beyond the tolerance of rainbow trout and any individuals displaced in July through September would be unlikely to persist more than a few days. Rainbow trout displaced downstream could persist for several months in the spring to early summer and overlap with NH gartersnake during that time.

The displaced rainbow trout are small (10-12 inches) and are unlikely to be able to prey on life stages of NH gartersnake except for very small (seven to 10 inches) neonates. Larger trout may harass neonates and could injure them. The displaced trout may also be too large to be preyed on by NH gartersnake, but this may occur. Warmwater nonnative fish, including green sunfish, largemouth bass, smallmouth bass, and yellow bullhead as well as bullfrogs and crayfish

dominate the lower reaches of Tonto Creek where NH gartersnake is extant and have significant effects to the native fish prey base for NH gartersnake in this area. The potential effects to NH gartersnake in lower Tonto Creek from stocking in the headwaters are very limited.

#### Stocking locations with effects to NH gartersnake or prey base

##### *Canyon Creek Complex*

#### **Description of the action area**

Canyon Creek is the only stocking site in this complex, with both rainbow trout and brown trout proposed for stocking. The action area is identified as Canyon and Mule Creeks from their headwaters down to where the road designated as FR 358 on the Tonto National Forest crosses Canyon Creek on the WMAT. We selected this as the downstream limit of the action area due to summer temperatures that would prohibit establishment of trout populations below this point. Temperatures are above the tolerances for rainbow trout in Canyon Creek near the WMAT boundary, and while brown trout can persist in warmer waters, it is unlikely that suitable temperatures exist much beyond this location.

#### **A. Status of the species within the action area**

NH gartersnake were recorded from the Canyon Creek stocking reach in 1986 and 1990, but were not found in 2004-05 or later surveys. It is unknown if NH gartersnake are on the White Mountain Apache Tribe lands immediately downstream of the stocking site, so for the purposes of this analysis, it is assumed that NH gartersnake could be in the vicinity of the proposed action.

#### **B. Factors affecting the species' environment within the action area**

The action area contains suitable habitat for NH gartersnake, with self-sustaining desert sucker and speckled dace populations to provide a prey base. Both rainbow trout and brown trout also reproduce in portions of the action area, and small trout also provide forage for NH gartersnake. Nowak (2006) and Brennan and Rosen (2009) documented NH gartersnake eating small brown trout in Oak Creek, and small brown trout from this reproducing population may also contribute to the forage base here.

The natural hydrograph is present in Canyon and Mule creeks in the action area. There is water use by the Forest Service campground and the Canyon Creek State Fish Hatchery. The Rodeo-Chediski Fire in 2002 burned a portion of the headwater area, and post-fire runoff reduced fish populations. Native fish recovered, and trout were restocked. There are no crayfish in Canyon Creek. The reason NH gartersnake have not been detected after 2002 may be related to the post-fire runoff or the heavy recreational use that the area receives during the summer which can lead to intentional killing of NH gartersnake. The status of NH gartersnake on the WMAT is unknown, and there may be factors operating there that have affected the population in the Forest.

#### **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native fish, amphibian, and reptile species. Additional discussions on the effects of nonnative stocked sportfish species to the NH gartersnake are in the recovery plan (NMDGF 2007). This document is incorporated by reference. The following discussion of effects is only a brief summary of the potential for predation and/or competition and by the stocked sportfish species on NH gartersnake.

If NH gartersnake are present in the stocking reach, neonates and juveniles are at risk from predation by adult brown trout and adult NH gartersnake may be harassed by trout and displaced from optimal habitats. Pools are important NH gartersnake habitat and are preferred by brown trout. Riffles are also important for NH gartersnake, and contain fewer trout. Brown and rainbow trout also have effects to the native fish that support NH gartersnake, with predation on young fish that are in the size range most suitable for smaller NH gartersnake the primary targets for trout predation.

Continuation of the sportfish stocking here also perpetuates the risk of intentional killing of NH gartersnake by anglers. Non-angling recreationists also frequent the area, and would continue to do so without a fishery, so the proposed action is not the only source of this risk. Anglers moving along the streambanks can also affect vegetation such as grasses and sedges that provide cover for NH gartersnake.

## CUMULATIVE EFFECTS

Canyon Creek is on the Tonto National Forest. Land management actions including management of recreation, livestock use, forestry practices, and watershed management on the forest are subject to additional section 7 consultation. The Canyon Creek Hatchery is operated by AGFD to produce rainbow trout. HAACP and management plans reduce the risk of introduction of new diseases or parasites to the action area via the hatchery. This is discussed in more detail in the area wide effects section of this BCO.

Use of live bait fish is illegal in Canyon Creek.

### *Granite Creek Complex*

#### **Description of the action area**

The Granite Creek Complex is in the headwaters of the Verde River. Three stocking sites,

Goldwater Lake, Watson Lake, and Willow Creek Lake have the potential to spill into the upper Verde River. Stocked fish species most likely to access the river are rainbow trout, bluegill, and black crappie, with a much lesser risk of stocked largemouth bass; since they would only be stocked in Goldwater Lake, 8.5 miles upstream of Watson Lake. Wild largemouth bass are in Watson Lake and are more likely than bass from Goldwater Lake to access the river but these are not stocked fish. Spills from Watson or Willow Creek lakes do occur, with water from these reservoirs sometimes reaching the upper Verde River via Granite Creek, as in 1993 and 2005. The action area is defined as Granite Creek at Watson Dam downstream to its confluence with the upper Verde River, and the upper Verde River from Sullivan Lake to the Tapco Diversion Dam.

#### **A. Status of the species within the action area**

Based on historical survey data, NH gartersnake occupied the upper Verde River from at least Perkinsville downstream to Tapco Diversion Dam. There are few records for NH gartersnake in this area, and the population, while presumed extant, is likely of low density. Three NH gartersnake were detected in the action area in summer 2010.

#### **B. Factors affecting the species' environment within the action area**

Until the mid 1990s, the upper Verde River supported a robust native fish population, with roundtail chub, suckers, and longfin dace present to provide the prey base for NH gartersnake. Since then, the native species populations, particularly roundtail chub and longfin dace, have declined significantly as populations of nonnative green sunfish, red shiner, and smallmouth bass expanded in the area. The reason for this change in fauna from native to nonnative is unclear; but there is no apparent recovery of native populations occurring. Flooding in the 1990s altered habitat conditions in the reach through erosion that may have been a factor in the decline of native species. Drought-related reductions in flood flow cycles that support native fish recruitment may be a factor, but the native species are not increasing after a flood, as would be expected, and this may be related to changes in habitat composition.

### **EFFECTS OF THE ACTION**

Effects of the stocking of sportfish into the Granite Creek reservoirs would occur if stocked fish or their progeny escape from the reservoirs during controlled releases or flood flows and access the upper Verde River. The potential for escapement from the Granite Creek stocking sites is limited to periods when the reservoirs spill. Such winter events possibly occurred three times between 1965 and 1984 and definitely in January and February 2005, January 2008, and January 2010. All species proposed for stocking (except rainbow trout) are already in one or more of the Granite Creek reservoirs (black crappie was known historically from all three but is only currently documented from Watson Lake), and stocking under the proposed action does not increase the potential for these species to reach the Upper Verde River.

Largemouth bass are of particular concern due to their high level of predation risk to small native fish. Black crappie over 100 millimeters switch from being planktivores to focusing on threadfin shad (Minckley 1973), and thus pose a predation risk to small roundtail chub. Bluegills are not



particularly predaceous, but do consume fish larvae or small fishes on occasion (Minckley 1973). Stocked rainbow trout are documented feeding on loach minnow (Propst et al. 1998), and are capable of preying on small roundtail chub or other small native fish. The risk of predation by these species on roundtail chub is facilitated by the shared preference for pool habitats by the four nonnative species.

Larger sub-adult or adult NH gartersnake are unlikely to be preyed on by these nonnative species; however trout and black crappie may be able to harass smaller NH gartersnake. There could be displacement of small NH gartersnake from pool habitats if these nonnative species are present and conditions are crowded.

The magnitude of potential effects from rainbow trout, bluegill, or black crappie accessing the upper Verde River on the prey base of NH gartersnake should consider the relative infrequency of spill events occurring and the likelihood that few individuals of the stocked species would be transported out of the lakes at any one spill event. The additive effect of the occasional rainbow trout, bluegill, or black crappie is not significant, nor does stocking support the populations of nonnative fish already present in the river.

#### CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The stocking sites and Granite Creek are on private lands and state lands north of Prescott, Arizona. This area is growing and continuing urban development in Chino Valley, Prescott, and Prescott Valley is anticipated. This area lacks significant amounts of surface water to support additional growth, and additional groundwater development is foreseen. The aquifer that supports the headwaters of the Verde River is in the area proposed for future groundwater development, and there is considerable research ongoing to assess potential effects to the river. The future approvals for groundwater activities may, or may not involve a Federal nexus, so it is not certain what portions of those projects would require section 7 consultations.

The upper Verde River is on private, state, and Prescott National Forest lands. Land management actions including management of recreation, livestock use, forestry practices, and watershed management on the Prescott National Forest are subject to additional section 7 consultation. Most of the upper Verde River from the vicinity of Stillman Lake downstream to the forest boundary is part of a state wildlife area or owned by The Nature Conservancy. Private inholdings exist on the river at Verde Ranch, Perkinsville, and Packard Ranch.

Use of live baitfish is not allowed at the Granite Creek stocking sites; however, tiger salamanders can be used as bait. Tiger salamanders are generally not used by anglers pursuing rainbow trout, bluegill, or black crappie but they are used for largemouth bass. Tiger salamanders are predators that can prey on small fish. The extent of nonnative tiger salamander populations in the upper Verde River is unknown; however, they generally are not found in rivers, so may be of limited

impact to the native fish communities that support NH gartersnake.

### *Middle Verde River Complex*

#### **Description of the action area**

The Middle Verde River complex contains five stocking sites where stocked warmwater fish and rainbow trout are stocked into or adjacent to occupied NH gartersnake habitat and individual NH gartersnake and their prey base could be affected by the stocking. The action area for this complex is the mainstem Verde River from the Tapco Diversion down to the confluence with Fossil Creek including the perennial drainages of Oak, West Clear, and Wet Beaver to the upstream ends of the stocking sites and the ponds at Dead Horse Ranch State Park.

#### **A. Status of the species within the action area**

NH gartersnake is found in low densities along the mainstem Verde River from Clarkdale to the confluence with Fossil Creek. Individuals may be present in any watered area along this reach; however, the number of individuals at any one location is unknown. There are no records for West Clear Creek or Wet Beaver Creek; however, these waters connect to the Verde River and may be occupied at levels similar to that in the mainstem. On Oak Creek, NH gartersnake are found from the confluence with Pumphouse Wash in the headwaters downstream to the vicinity of Grasshopper Point/Midgely Bridge. Brennan and Rosen (2009) reported that the NH gartersnake population in Oak Creek and West Fork Oak Creek is present in large numbers in the best habitat areas, with fewer individuals present at other locations. They also report that there is some evidence of a decline in numbers since the 1980s, and that the stability of the population over the long term may not be assured.

#### **B. Factors affecting the species' environment within the action area**

The status of NH gartersnake in the Verde River action area is a result of a variety of threat factors, but particularly the expansion of nonnative invertebrates, amphibians, and fish both in terms of the number of such species and the expansion of them across the watershed. The native fish fauna, primarily in the form of suckers and roundtail chub is extant, but is at differing densities in various locations across the area, and the robustness and extent of recruitment (NH gartersnake can only prey on small individuals) is uncertain. Other potential native fish prey species still present are Gila chub (in Spring Creek, a tributary to Oak Creek), and longfin dace. Potential nonnative prey species include red shiner, mosquitofish, and small brown or rainbow trout from the wild populations. The current fish fauna of the action area is largely dominated by centrarchids (smallmouth bass, largemouth bass, green sunfish), ictalurids (channel catfish, flathead catfish, and yellow bullhead), and red shiner. In upper Oak Creek, brown trout are a significant portion of the fauna and comprise a significant proportion of the prey base. All the species above are predators or competitors on the native fishes prey base for NH gartersnake.

The Oak Creek population is also at considerable risk from humans. Oak Creek is a heavily used recreational area, with numerous picnic areas, campgrounds, parks, residences, and rental lodges on and along the creek. Human use along the creek can reduce shoreline vegetation important as

cover for NH gartersnake. Humans may also kill snakes when seen, or, capture them to keep as pets. Nowak (2006) found one NH gartersnake being carried away from the stream by a visitor.

Portions of the action area are subject to significant water diversions that affect the amount and quality of aquatic habitats that may also have effects on the native and nonnative aquatic species populations. Particularly through the Verde Valley (Clarkdale to Camp Verde), summer flows become low and water quality suffers as natural flows are diverted for agricultural and other purposes. Because Verde River flows in the action area are not controlled by upstream water storage, and in the natural hydrograph, summer flows tend to be low; these diversions have a considerable affect on the aquatic communities in the reach. Low flows concentrate aquatic species in remaining pool habitats when runs and riffles become too shallow for fish, and this can lead to increased competition for scarce resources, and direct predation events. Water quality may not be suitable and result in death of individuals of species not as able to tolerate poor conditions. Diversions on the Verde River tributaries in this reach reduce those inflows, and reduce habitat quality below the diversions there. Below Camp Verde, other inflows restore base flow in the river, but it is still less than it would have been historically.

#### EFFECTS OF THE ACTION

Rainbow trout are the only sportfish species included for the proposed action in the Verde River, with additional warmwater species proposed for Deadhorse Lake. Fish stocked into Deadhorse Lake are in a closed system and unless NH gartersnakes move to the lake to forage, would not come into contact with these species.

In the middle Verde River, 30,000 would be stocked annually between November and March; in Oak Creek, 60,000 would be stocked annually from March to November, and 6,000 each would be stocked into West Clear and Wet Beaver creeks in March to May and October to November. Usually, the mainstem Verde River becomes too warm to sustain rainbow trout over the summer; however, stocked rainbow trout have been found as late as August (Bonar et al. 2004). The lower part of Oak Creek below the stocking site becomes unsuitable for trout persistence during the summer. Because rainbow trout do not breed in the mainstem Verde River (although they do in upper portions of the Oak Creek stocking reach), rainbow trout found in the mainstem Verde River are assumed to be stocked fish.

As described in Appendix D on sportfish-native fish interactions, rainbow trout are variably piscivorous, with the level of piscivory dependent on a number of factors. Hatchery-reared rainbow trout are also variable in the speed at which they convert to foraging for wild prey once stocked into a location. The length of time a stocked rainbow trout is at large in the system is a factor in whether it does not convert to a wild diet. Further, when stocked in larger numbers than an immediate habitat area can support, and when the available habitat already contains populations of territorial or aggressive nonnative species, the hatchery rainbow trout is at a disadvantage in selecting prime habitats and foraging locations in the vicinity of the stocking site. These hatchery rainbow trout may then be found in areas of the waters where, under “normal” circumstances, they might not select. These areas may also bring them into contact with small native fish larvae or juveniles, allowing opportunity for predation. Propst et al. (1998) documented stocked rainbow trout preying on loach minnow in the Gila River. Bonar et

al. (2004) discussed the relative piscivory of nonnative fishes in the Verde River. Part of their study area was in the action area, and they were able to make some observations about the piscivory of the stocked rainbow trout. Bonar et al. (2004) in the Verde River observed that the stocked rainbow trout were primarily insectivores; however, they did consume small fish (only nonnative fish were documented), and, in their study, rainbow trout had the second highest consumption rate of fish (after largemouth bass). Bonar did identify a concern that if present in large numbers, stocked rainbow trout could have an effect on native fish recruitment through predation, particularly if their presence came during the spawning period for the native fish species. However, the authors did note the limitations of the study (only 32 rainbow trout were captured) and recommended additional research be conducted on this topic prior to modifying stocking practices.

Young native suckers and roundtail chub are potential prey items for NH gartersnake, as are speckled dace and longfin dace. Bryan et al. (2002) observed that native Sonora and desert suckers in the lower Verde River (below Bartlett Dam, outside of the action area) began spawning in mid-February through July, and that water temperatures were a cue to spawning. Roundtail chub, which are an important prey species for NH gartersnake, begin to spawn in the reach in April. Spawning temperatures in the action area are suitable for both suckers and roundtail chub to breed during the period when stocked rainbow trout are present in the river and its tributaries. These small larval or young of the year native fish are found in low flow areas, including pools, backwaters, and runs, generally in shallow waters with variable cover (Bryan et al. 2002). These are areas where rainbow trout, among other potential predators, are also found.

As indicated by Bonar et al. (2004), rainbow trout are not the only potential predator of native fish in the Verde River. Largemouth bass is the most significant predator, with the other warmwater species including channel catfish, flathead catfish, smallmouth bass, and yellow bullhead also regularly consuming fish. Native fish consumption in the spring and summer was high for these species, likely due to the availability of small native fish after the spawning period. Bonar et al. (2004) suggests that the extant nonnative fish community, including rainbow trout, could be negatively impacting recruitment of native fishes. The most robust populations of native fish in the Verde River are below Bartlett Dam, outside of occupied NH gartersnake habitat. Populations of these species within occupied NH gartersnake habitat are not as robust, which may be a result of continuing high levels of predation by nonnative species. In addition to nonnative fish, crayfish and bullfrogs are also present in the system and have adverse effects on NH gartersnake, particularly neonates and juveniles.

The area of Oak Creek that supports NH gartersnake contains both native and nonnative fish. Suckers and speckled dace are present throughout, with brown trout exhibiting a patchy distribution. Wild rainbow trout were present in some areas. NH gartersnake are fish specialists, and young of the year or juvenile fish are particularly important. In Oak Creek, juvenile wild brown trout were important prey items. Warmwater species such as smallmouth and rock basses are rare above the Midgely Bridge/ Grasshopper Point area. Nonetheless, NH gartersnake populations in that portion of Oak Creek area have experienced significant declines since the 1980s.

The loss of the natural prey base has several effects on gartersnakes. Most importantly, the

reduction in available prey increases foraging time, which has an energy cost and may make the individual more at risk of predation. Changes to the forage base also affect growth and health, as a diverse forage base with both larger and smaller prey items provides more opportunities to capture prey and to capture larger prey which is more energy efficient (Rosen et al. 2001). Reduced recruitment and increased over-wintering mortality result from poor nourishment during the active season. Attempts to prey on spiny-rayed nonnative fish may result in injury or death due to choking or injury from spines (Nowak and Santana-Bendix 2002, USFWS 2008b).

An important indirect effect for NH gartersnake along the stocked portion of Oak Creek where the species is extant is the deliberate killing of snakes by humans. Increased human use results in the trampling of near-shore vegetation, which reduces cover for gartersnakes, especially newborns. Increased human visitation in occupied habitat also increases the potential for human–gartersnake interactions, which frequently leads to the capture, injury, or death of the snake (Rosen and Schwalbe 1988, Ernst and Zug 1996, Green 1997, Nowak and Santana-Bendix 2002). Anglers pursuing stocked sportfish along Oak Creek may come into contact with individual NH gartersnake at these sites. There is less risk of angler-related mortality of NH gartersnake along the middle Verde stocking site because rainbow trout are stocked between November and March and NH gartersnake are active March through November. There is thus a limited time period in November and in March through May when anglers pursuing stocked rainbow trout may encounter NH gartersnake. Intentional killing is of particular concern along upper Oak Creek due to the presence of the robust population of NH gartersnake present in that portion of stocking reach. The amount of this mortality is unknown; but Brennan and Rosen (2009) identified this effect as difficult to dismiss due to the proximity of NH gartersnake to campgrounds and recreation sites along Oak Creek.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Verde River stocking sites are on a mix of Coconino National Forest, state, and private lands. Land management actions including management of recreation, livestock use, forestry practices, and watershed management on the Coconino National Forest are subject to additional section 7 consultation. Activities on the state and private lands are not, and, particularly, management of water use and diversions is in private control. Water availability through the Verde Valley may be having effects to native fish populations there, and that may influence the NH gartersnake population in that reach. Low water levels may also make NH gartersnake neonates or juveniles more susceptible to predation by nonnative species that also has adverse effects to the population. There are various efforts ongoing in the Verde Valley to address future water use and we anticipate that these efforts will continue over the next 10-year period.

Use of live baitfish (fathead minnow, threadfin shad, red shiner, mosquitofish, sunfish, and carp) is legal in the Verde River below Tuzigoot Bridge, which is in the action area. Use of live baitfish in Oak Creek is not legal, but use of tiger salamander is legal throughout the action area.

According to AGFD Fishing Regulations, live baitfish cannot be transported to the Verde River above Horseshoe Dam but they can be collected on-site for use. Live bait species are not used to fish for stocked rainbow trout, but can be used for warmwater fish such as largemouth bass and smallmouth bass. It is also illegal to release any live bait species into any Arizona waters; however, there is angler release of these species. Baitfish species captured on-site in the Verde River are not likely to contribute to the spread of new diseases or parasites since they are already exposed to those in the watershed.

### *San Francisco River Complex*

#### **Description of the action area**

Luna Lake is the only stocking site in this complex, and is stocked with rainbow trout and cutthroat trout. The action area is defined as the San Francisco River from Luna Lake downstream to the town of Glenwood, New Mexico, and including the lower portions of the Tularosa River and Negrito Creek.

#### **A. Status of the species within the action area**

NH gartersnake is extant in the San Francisco River, with recent captures in the vicinity of “The Box” upstream of Reserve, the Tularosa River, and Negrito Creek and near Alma Bridge and at Whitewater Creek. The Whitewater Creek population is the most robust in New Mexico. The Tularosa and Negrito Creek sites also appear to have healthy populations of NH gartersnake based on surveys in 2008 and 2009.

#### **B. Factors affecting the species’ environment within the action area**

The upper San Francisco River sites have some nonnative fish species present, including rainbow trout, and crayfish numbers appear to be increasing, particularly near The Box. Native fish, particularly suckers, remain reasonably abundant; however, roundtail chub are likely extirpated. A new water diversion below The Box could reduce flows and affect habitat and native fish prey base.

The Alma Bridge site has been compromised with more nonnative fish species, including channel catfish, and increasing numbers of crayfish. The Whitewater Creek site remains in good condition, with few crayfish and a good native fish community, augmented by small rainbow trout that also provide forage for NH gartersnake.

The San Francisco River has suffered from erosion and extensive water diversion and at present has an undependable water supply throughout much of its length. Much of the flow below Luna Lake is diverted for agricultural purposes, with permanent flow resuming about 5.5 miles downstream, which is above the upper boundary of the critical habitat at The Box. In the vicinity of Reserve and Glenwood there are agricultural areas and small towns on the private lands.

#### **EFFECTS OF THE ACTION**

Impacts to NH gartersnakes from stocking rainbow and/or cutthroat trout into Luna Lake are related to trout potentially escaping Luna Lake during times of the lake spilling (snow melt, monsoonal discharges, or from irrigation water releases through the headgate in the dam during summer months) and potentially moving downstream in the San Francisco River to occupied NH gartersnake habitats in that river, the Tularosa River, and North and South forks of Negrito Creek.

Rainbow trout fishing is reportedly good between Luna, New Mexico and the Arizona stateline, as well as at the Frisco Box a few miles downstream of that. Cutthroat trout have not been documented in any surveys in the action area outside of Luna Lake. No trout are legally stocked in the San Francisco River in New Mexico, so the origin of these trout is unknown and some may originate in Arizona from Luna Lake. Wild rainbow trout are also found in the Tularosa River, and rainbows and rainbow-Gila hybrids are reported from South Fork of Negrito Creek and the mouth of North Fork of Negrito Creek, which in some years have some of the best trout fishing on the Gila National Forest (Johnson and Smorynski 1998). Rainbow trout in these systems are not supported by current stocking actions in New Mexico, and are most likely wild fish with self-sustaining populations. Based on the physical information about the reach of the San Francisco River from Luna Lake to occupied NH gartersnake habitat, including the distances involved, the likelihood of rainbow trout from Luna Lake supporting or augmenting the wild trout populations in NH gartersnake habitat is doubtful; however, as a conservation measure, AGFD will share information with the NMDGF on salmonid populations in occupied habitats.

#### CUMULATIVE EFFECTS

Use of live baitfish at Luna Lake is prohibited, however, waterdogs are allowed. Fathead minnow and waterdogs are found in the lake. The initial sources of these species are unknown; however, fathead minnows are also found in the river below the lake as far downstream as Glenwood (Paroz et al. 2009). There is no impetus to establish live bait populations for use in Luna Lake to pursue stocked trout.

Luna Lake is on the Apache National Forest. Recreational facilities and the concession are managed or licensed by the Forest Service. Watershed activities are also managed by the Forest Service. Water releases from the lake are managed by the Luna Irrigation Company (which owns most of the water rights outside of a minimum pool right owned by AGFD). Below the lake along the San Francisco River, most of the land is on the Apache and Gila National Forests, with private inholdings concentrated at the towns of Luna, Reserve, Alma, and Glenwood. Watershed management is primarily by the Forest Service, with local water use and development activities on private lands subject to limited Federal involvement.

#### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in area-Wide section). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites,

or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

Illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. The Area-Wide analysis discusses this effect in more detail.

Disease and parasites are additional threats to native fish species that are part of the prey base for NH gartersnake. Disease and parasites are additional threats to native fish populations. Parasites may be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect native fish populations that are the prey base for NH gartersnake. Susceptibility and concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

### Summary

The status of NH gartersnake in the United States is precarious. Robust NH gartersnake populations in Arizona are in upper Oak Creek, with less robust populations in the mainstem Verde River, portions of the Black River, the Blue River and Tonto Creek. In New Mexico, robust populations are in Whitewater Creek, the Tularosa River, and Negrito Creek. Less robust populations are in the East Fork Gila River, Gillita Creek, and Little Creek. The Oak Creek population has declined, particularly in the lower reaches, Slide Rock State Park, and near Midgely Bridge (Nowak 2006). The long-term viability of the other extant populations is difficult to predict; however, expansion of nonnative fish, bullfrogs and crayfish into extant habitats in New Mexico is continuing and may affect those populations more over time. The remaining Arizona populations are already subject to stresses from nonnative species. The long-term viability of the other populations, based on the very low number of adults documented even in extensive surveys (Holycross et al. 2006) is in question. At low densities, it can be difficult for males and females to meet, which reduces the opportunity for mating. Additionally, NH gartersnake takes two to three years to mature, and insufficient survival rates of neonates and juveniles reduces the adult population.

The two factors above, in combination, raise significant issues for the persistence of many NH



gartersnake populations over the next 10 years. We have not completed the status survey for NH gartersnake, however, there are many similarities in both the ecology and threats pertaining to NM gartersnakes and NH gartersnake, which make it likely that NH gartersnake are affected similarly as NM gartersnake. This issue received detailed analysis in the 2008 12-month finding for NM gartersnake (USFWS 2008b). The summary of that discussion concluded that if we extrapolate the last 20 years of population trends from survey data, unless considerable conservation work is accomplished, the number of populations will decline, and the status of any currently stable populations may be compromised. This is not to say that NH gartersnake, in its entirety, will be extirpated during this time frame because it would remain plausible that extremely low-density populations of a few individuals may persist in other areas past this time frame.

## CONCLUSION

After reviewing the current status of NH gartersnake, the environmental baseline for the action area, the effects of the proposed stocking actions described above, and cumulative effects, it is the FWS's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of NH gartersnake. NH gartersnake is in process to become a candidate species, so no critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on NH gartersnake for the following reasons:

- The proposed action, through intentional killing of NH gartersnake by anglers along Oak Creek may have continuing adverse effects on a population weakened by other causes such as nonnative predation on NH gartersnake and an altered or diminished prey base. The population remains robust at locations away from heavy visitor use; however, long-term monitoring is needed to document changes to population viability.
- The numbers of rainbow trout or cutthroat trout accessing NH gartersnake habitats in the San Francisco River, Tularosa River, and Negrito Creek are likely to be small and persistence limited. Trout are predators on fish species that support NH gartersnake populations; however, the magnitude of the contribution of trout from Luna Lake is very limited.
- Most of the sportfish stockings considered in this analysis are of rainbow trout. While rainbow trout are predators on small fish, they constitute a smaller risk to the native prey base of NH gartersnake than the warmwater species that are extant in those areas. Juvenile trout also likely provide a prey base for NH gartersnake in some areas.
- The proposed action does not result in any additional effects from stocked sportfish that are not already part of the environmental baseline. These effects are expected to continue at their present level over the 10-year period covered by this consultation.
- The proposed action contains a significant conservation effort for the narrow-headed gartersnake that will work to offset the effects of the action and provide additional

conservation benefit.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### **AMOUNT OR EXTENT OF TAKE**

The prohibitions against taking NH gartersnake found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for this species at this time. The proposed action, through the Conservation and Mitigation Program, is providing conservation measures directed to address potential take that may result from the proposed action. If and when the NH gartersnake is proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement at that time.

### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of recovery/conservation strategies for NH gartersnake contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery actions for NH gartersnake under the auspices of the CAMP provides conservation benefits to NH gartersnake that may not be otherwise realized.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

### Northern leopard frog (*Lithobates* (= *Rana*) *pipiens*)

#### DESCRIPTION OF THE PROPOSED ACTION

Northern leopard frogs may be affected by sportfish stocking in the following stocking complexes (Table 33). New stocking sites or new species proposed for continuing stocking sites are indicated by a \*. Only stocking sites in a complex where effects could occur are listed.

Table 33: Stocking sites, sportfish species proposed for stocking, and potentially affected northern leopard frog populations

| Stocking complex/site                         | Species stocked               | Northern leopard frog population |
|-----------------------------------------------|-------------------------------|----------------------------------|
| <i>Black Canyon Lake</i>                      |                               |                                  |
| Black Canyon Lake                             | ONMY, SAFO*                   | Within dispersing distance       |
| <i>Canyon Diablo</i>                          |                               |                                  |
| Ashurst Lake                                  | ONMY, ONCL, SATR, SAFO, ICPU  | Within dispersing distance       |
| Coconino Lake                                 | ONMY, ONCL, SATR, SAFO, THAR  | Within dispersing distance       |
| Kinnikinick Lake                              | ONMY, ONCL, SATR, SAFO, THAR, | Within dispersing distance       |
| Morton Lake                                   | ONMY                          | Within dispersing distance       |
| Mud Tank                                      | ONMY,                         | Within dispersing distance       |
| <i>Little Colorado River above Lyman Lake</i> |                               |                                  |
| Lyman Lake                                    | ONMY                          | Occupied                         |
| <i>Upper Little Colorado River</i>            |                               |                                  |

|                                        |                                               |                                                        |
|----------------------------------------|-----------------------------------------------|--------------------------------------------------------|
| Concho Lake                            | ONMY, ICPU*, MISA*, LEMA*                     | Historical record at lake, no recent surveys completed |
| <i>Walnut Canyon</i>                   |                                               |                                                        |
| Marshall Lake                          | ONMY, SAFO, THAR                              | Occupied sites nearby                                  |
| Mormon Lodge Pond                      | ONMY, LEMA, LEMI*                             | Occupied sites nearby                                  |
| Lower Lake Mary                        | ONMY, ICPU, LEMA, LEMI*                       | Occupied sites nearby                                  |
| Upper Lake Mary                        | ONMY, ONCL*, SATR*, SAFO*, ICPU, LEMA*, LEMI* | Occupied sites nearby                                  |
| <i>West Fork Little Colorado River</i> |                                               |                                                        |
| Lee Valley Lake                        | ONAP, THAR                                    | Historical range, known populations distant            |
| Mexican Hay Lake                       | ONAP                                          | Historical range, known populations distant            |
| White Mountain Reservoir               | ONMY                                          | Historical range, known populations distant            |
| West Fork at Greer                     | ONAP, ONMY                                    | Historical range, known populations distant            |
| West Fork at Sheeps Crossing           | ONAP                                          | Historical range, known populations distant            |
| Bunch Reservoir                        | ONAP*, ONMY                                   | Historical range, known populations distant            |
| Tunnel Reservoir                       | ONAP*, ONMY                                   | Historical range, known populations distant            |
| River Reservoir                        | ONAP*, ONMY                                   | Historical range, known populations distant            |
| <i>San Francisco River</i>             |                                               |                                                        |
| Luna Lake                              | ONMY, ONCL                                    | Historical records in vicinity, no recent surveys      |

#### Conservation measures included in the proposed action

Northern leopard frog is a priority species for conservation in the proposed action and as such, will receive benefits from both general and specific conservation actions to address the effects of sportfish stocking on the species.

AGFD commits to provide for two northern leopard frog populations either through securing existing but threatened populations or establishment of new conservation populations. The first population will be initiated within four years and the second population within six years.

For warmwater sport fish stocking actions via contract vendors at sites where effects to northern leopard frogs are a concern, the “sensitive areas” HACCP plan shall be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan involves the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted

aquatic organisms with the sport fish. Loads containing unwanted aquatic organisms will be refused and not stocked. This measure will be implemented as needed.

For coldwater sport fish stocking actions at sites where effects to northern leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery will be in place to reduce the risk of contamination of the fish to be stocked. This measure has been ongoing and will continue to be implemented as needed. Funds expected to implement these activities do not contribute to meeting the average annual funding requirement of \$500,000.

Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population in the vicinity of wild or reintroduced populations of northern leopard frog.

Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the AGFC for implementation consideration.

Within three years, AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.

Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

The AGFD shall share information with, and periodically solicit available information from, the NMDGF to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and gartersnake populations in the San Francisco River drainage.

#### STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide and/or recovery unit)

##### *Listing*

The western populations of northern leopard frog were the subject of a positive 90-day finding in 2009 (74 FR 31389) and a 12-month review is underway.

##### *Background*

The following information is a summary of life history, habitat use, current distribution, threats, and conservation actions for the northern leopard frog. This information was taken from the 90-day finding (USFWS 2009i). Information in from this document is incorporated by reference.

### Life history

The northern leopard frog is a smooth-skinned green, brown, or sometimes yellow-green frog with large, oval dark spots surrounded by a lighter border or halo. Adult snout-vent lengths are two to 4.5 inches. They lay egg masses in shallow, still water that is exposed to sunlight, usually attached to vegetation just below the surface of the water. Tadpoles are generalist herbivores eating attached and free-floating algae. Adult and subadult frogs are generalist insectivores with prey including insects, spiders, mollusks and crustaceans.

### Habitat use

A variety of habitats is needed by different life stages of northern leopard frog and includes overwintering, breeding, foraging, and upland post-breeding habitats. Adults overwinter on the bottom of deeper streams or pools that do not freeze to the bottom. Breeding habitats include slow-moving or still waters along streams and rivers, wetlands, permanent or temporary pools, beaver ponds, earthen stock tanks, or other human-created waters. Emergent vegetation and other types of cover are important features for breeding sites and tadpole habitats. Metamorphosed and adult frogs will disperse from the breeding area along drainages to feeding sites in open or semi-open wet meadows and fields with shorter vegetation usually near the margins of water bodies.

### Current distribution

The western populations of northern leopard frog are found in Arizona, California, Colorado, Idaho, Iowa, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, Washington, Wisconsin, and Wyoming. It has declined significantly in all these states, and is or is almost completely extirpated in California, Oregon, Texas, and Washington.

### Threats

Threats facing the northern leopard frog identified in the 90-day finding include loss and degradation of habitat due to improper livestock grazing, agricultural development, urban development, oil and gas development, road development, poor forestry practices, groundwater pumping, mining, and invasive species. Of relevance to this consultation, the introduction of nonnative invertebrates (crayfish), amphibians (bullfrogs) and fish species has adverse affects to northern leopard frog through degrading habitat conditions and direct predation on eggs, tadpoles, and adult frogs. Additionally, northern leopard frog populations are subject to die offs caused by a fungal skin disease – chytridiomycosis, that has expanded across the western United States in part through introductions of nonnative tiger salamanders and bullfrogs that carry this disease.

### Conservation actions

As part of their ongoing commitment to conservation for this species, AGFD is an active

participant in implementation of conservation actions for the northern leopard frog. Surveys for the northern leopard frog have been accomplished through the cooperation of partners (AGFD, Coconino National Forest, and FWS). The AGFD Heritage Fund provided funding for an ongoing genetics study.

#### *Previous consultations*

The species is not currently a listed, proposed or candidate species under the ESA so has not been the subject of previous section 7 consultations.

#### ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Six of the stocking complexes are in the Little Colorado River drainage, and one is in the San Francisco River drainage. Two of the six Little Colorado River complexes are adjacent to one another, and the West Fork Little Colorado River and Little Colorado River above Lyman Lake are hydrologically connected but geographically distant. We shall evaluate each stocking complex separately except the two adjacent sites, beginning with those where effects to northern leopard frog are expected to be limited in scope.

#### Sites with limited potential to affect northern leopard frog

##### *Black Canyon Complex*

Black Canyon Lake is in the historical range of the northern leopard frog, and there are recent (2004) records of northern leopard frog four miles downstream of the lake in Black Canyon. There are crayfish in the lake along with illegally stocked largemouth bass and green sunfish in addition to the two stocked trout species. When the lake spills during years with heavy snowpack or heavy winter rainfall, fish in the lake may be displaced downstream, toward where the northern leopard frog was found. The water in the canyon dries up, precluding survival of any fish species, in the vicinity of the northern leopard frog location. While there is an opportunity for predation on northern leopard frog, the period of potential exposure is low and but it does occur during the northern leopard frog breeding season. Any predation would occur in the spring; and the number of stocked fish present would vary from year to year with the amount of predation resulting also varying. In years when numerous stocked fish are present, there could be significant effects to northern leopard frog recruitment at those times; however, we believe this would be a rare occurrence and the effects insignificant.

##### *West Fork Little Colorado River Complex*

The West Fork Little Colorado River complex is in the historical range of northern leopard frog, but there are no records from any of the stocking sites. As noted previously, this complex is connected by the perennial Little Colorado River to Lyman Lake. However, the distance between the occupied habitats near Lyman Lake and the presence of nonnative fish and crayfish in the river likely results in a limited opportunity for dispersal of northern leopard frog to the West Fork area. Stocked sportfish in the West Fork are unlikely to reach Lyman Lake, so there is no exposure from these fish to the northern leopard frog near Lyman Lake. Any effects of stocked sportfish from the West Fork Sites to northern leopard frog are discountable.

#### *Upper Little Colorado Complex*

There is a historical record for northern leopard frog at Concho Lake, but no recent surveys have been conducted. Concho Lake is not within dispersal distance of known occupied northern leopard frog sites near Lyman Lake. Nonnative warmwater fish are present at the lake, as are crayfish; reducing the likelihood that northern leopard frog has persisted at this site. The presence of a historical record is sufficient for this site to be evaluated; however, adverse effects are unlikely to occur based on the probability that northern leopard frog no longer exist at this site.

#### *San Francisco River Complex*

Luna Lake is the only stocking site in this complex, and is within historical range but no northern leopard frog has been recorded at the lake. There are historical records within five miles of the lake, and additional surveys are needed to update northern leopard frog distribution in this portion of the range. There are crayfish and nonnative fish in both the lake and the river that likely results in limited opportunity for northern leopard frog to be present in the stocking site or downstream where stocked fish are known to escape from the lake during spring runoff and summer irrigation releases. The number of such trout that escape is unknown; however, they do not persist in the river due to high temperatures. While they may be present early in the northern leopard frog breeding season, they would not be expected to be present during the summer. Effects to northern leopard frog from stocked sportfish at Luna Lake or downstream in the San Francisco River are insignificant.

#### Sites with potential to adversely affect northern leopard frog

#### *Canyon Diablo Complex and Walnut Creek Complex*

### **Description of the Action Area**

The Canyon Diablo/Walnut Creek action area is defined as the stocking sites and the five-mile buffers around them. Buffer areas overlap between most of the sites, so the action area is fairly contiguous from Lower Lake Mary to Kinnickinick Lake.

#### **A. Status of the species within the action area**

All stocking sites are within the historical range of the northern leopard frog, and there are



historical records from Ashurst Lake and Lower Lake Mary. Three known occupied northern leopard frog sites are in tanks in the watershed within the five mile dispersal distance to the Canyon Diablo stocking sites or there are other tanks between the occupied sites and the stocking sites that could support northern leopard frog moving farther across the landscape. Occupied northern leopard frog habitat is in Mormon Lake and individuals may disperse to Mormon Lodge Pond and the other stocking sites.

## **B. Factors affecting the species' environment within the action area**

Existing populations of nonnative fish species and crayfish are the predominant factor affecting northern leopard frog in this area. All the stocking sites and most of the stock tanks that have permanent water have either crayfish or nonnative predatory fish or both. Not all the nonnative fish present are the result of sportfish stocking; yellow bullheads are present in some lakes and are predators on frogs. The presence of these nonnatives compromises the ability of these waters to support breeding northern leopard frog populations. Where the habitat at the water is complex (containing shallow areas, offsite marshy areas, abundant aquatic vegetation or other types of cover), northern leopard frog can persist and have a level of successful recruitment, but conditions are not optimum. Recent drought conditions in Arizona have also affected the amount of habitat available, as some stock ponds or small lakes may have dried up.

Except for Mormon Lodge Pond, all sites in these complexes are on the Coconino National Forest. Livestock management actions on the Forest do affect the suitability of stock tanks for northern leopard frog, but stock tanks managed to maintain riparian habitat can provide suitable breeding and/or stepping stone habitats. Forestry practices can affect runoff, which can affect flows into tanks or cause erosion that drops water tables under some of the transient waters in the action area. Recreational activities including angling, hiking, camping, and hunting occur in the action area.

Surveys for northern leopard frog and a Heritage-funded genetics study with USGS in the action area are the only ongoing conservation actions, although there are plans for some restoration and reintroduction activities in the future.

We believe the aggregate effects of actions described above, including natural factors such as drought, are responsible for the present precarious status of the northern leopard frog in the action area.

## **EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

As referenced previously, Appendix D contains compiled information on the effects of nonnative stocked sportfish species to native aquatic species including the northern leopard frog. Additional discussions on the effects of nonnative stocked sportfish species to the northern leopard frog are in the 90-day finding (USFWS 2009i) and literature cited therein. The following summary and discussion of effects for each action area focuses on the parameters that lead to the potential for predation and/or competition by the stocked sportfish species on northern leopard frog at each stocking site or complex.

Warmwater fish species, particularly channel catfish and largemouth bass are significant predators on ranid frogs including northern leopard frog. Brown trout are significant predators on vertebrates such as frogs, and rainbow trout, while believed to be less predatory on vertebrates, have had significant adverse effects on ranid frogs in some California lakes that were fishless prior to rainbow trout introduction. Trout stocked as fingerlings, subcatchables or catchables into lakes persist better than in streams, and convert to eating native foods more effectively than those in streams, thus are more likely to be predators on northern leopard frog eggs or tadpoles than trout stocked in streams.

All of the new species proposed for stocking at Upper and Lower Lake Mary are already stocked in some other sites in these drainages. Changes to the proposed action has reduced the number of stocking sites with channel catfish in the Canyon Diablo drainage to one (Ashurst Lake), where was historically stocked. Elimination of proposed channel catfish stocking from other lakes in this portion of the drainage may provide some additional opportunity for northern leopard frogs to use those habitats in dispersal. Brown trout are still stocked in the drainage, and they are predators on frogs, and remain a threat in the area.

In Upper Lake Mary, only brook trout have not been previously stocked into the lake, though there have not been stockings of brown trout, cutthroat trout, or redear sunfish in several years. Upper Lake Mary does not usually go dry, so any fish stocked can persist even if reproduction does not occur. Bluegill and redear sunfish are new species to the stocking list; however, they are present in the lake as self-sustaining populations from past legal stocking actions. Populations of these species may become depressed and AGFD may determine it is necessary to augment the population; however, the species would continue to be present in the lake without the augmentation, and the action would have little effect on restoration of population levels. Lower Lake Mary has been known to nearly dry completely, and AGFD proposes to add redear sunfish to augment the population. Since this species is already present in Upper Lake Mary, and the upper lake regularly spills to the lower lake, this addition to the stocked species list is not in reality a new species. Channel catfish will continue to be stocked in these two lakes, and northern leopard frogs using these lakes during dispersal events remain at risk of predation.

Northern leopard frog populations in complex habitats may be able to maintain populations in the presence of nonnative predatory fish species; however, it is not known if these populations would be sustainable in the long-term or in sufficient abundance to be source populations for nearby habitats. Permanent water habitats are the core of northern leopard frog populations in an area, because they are the breeding habitats that provide a source of dispersing individuals to less permanent waters to create a metapopulation within an area. Less complex habitats at some permanent water sites may not allow for any recruitment of northern leopard frog even if adult

frogs are able to persist. These sites are sinks that cannot contribute to the larger population structure. The number of extant populations of northern leopard frog in the action area is small, and many potentially available habitats are stocked with predatory sportfish under the proposed action. Dispersing northern leopard frogs that reach less complex habitats, such as at the Canyon Diablo stocking sites and remaining Walnut Creek sites, may not be able to establish populations there due to lack of underwater cover and the presence of stocked sportfish.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

As stated previously, all but one stocking site is on the Coconino National Forest, and most activities that could potentially affect northern leopard frog are subject to section 7 consultation. Activities on any private lands in the action area are not; however, we are not aware of any significant activities differing from the baseline that are proposed for the future.

Illegal stocking of nonnative fish, including northern pike, into the waters of the action area is a continuing problem for northern leopard frog as it increases the number of potential predators in those waters. The presence of northern pike also increases the risk of the illegal introduction of live baitfish or tiger salamanders to the area that are potential competitors, predators, and, in the case of the tiger salamander, disease vectors.

### *Little Colorado River above Lyman Lake Complex*

#### **Description of the Action Area**

The action area for this complex is Lyman Lake and the Little Colorado River for five miles above and five miles below the lake. This area includes the locations where trout stocked into the lake may be expected to move out of the lake and into northern leopard frog habitats.

#### **A. Status of the species within the action area**

Northern leopard frog have not been recorded at Lyman Lake, however, the lake is in the historical range and there is occupied habitat immediately downstream of the lake in the Little Colorado River. Additional surveys are needed to more fully define the extent of northern leopard frog occupancy. It is unlikely that northern leopard frog can establish populations in the lake or in the river above the lake due to nonnative fish and crayfish present there.

#### **B. Factors affecting the species' environment within the action area.**

Existing populations of nonnative fish species and crayfish are the predominant factor affecting northern leopard frog in this area. There is perennial flow in the river below the lake for about 15 miles until the water is mostly diverted for agriculture. Nonnative fish and crayfish are found

in these waters and affect their suitability for northern leopard frog. Lyman Lake and the Little Colorado River in the action area are on private and state lands, including a state park. Lands in the watershed are managed for livestock grazing and agriculture, with scattered residences. Recent drought conditions likely have reduced water releases from Lyman Lake, which may affect the amount of available habitat below the dam that supports northern leopard frog and dried up more of the pool habitats further downstream. We believe the aggregate effects of actions described above, including natural factors such as drought, are responsible for the present precarious status of the northern leopard frog in the action area.

## EFFECTS OF THE ACTION

Catchable rainbow trout are proposed for stocking into Lyman Lake in those years when water quality is likely to support the fishery. Rainbow trout were last stocked into Lyman Lake in 1996. Conditions since then have not been favorable for rainbow trout due to the high turbidity of the lake resulting from carp feeding on the lake bottom. We cannot predict the number of stockings would occur during the 10-year period covered by this consultation. Trout would be stocked in smaller lots multiple times over the year (up to 10,000 annually), so trout could be found in the lake at any time. The triploid trout will not reproduce in the lake, and if water quality degrades they will not persist. Any northern leopard frog that disperses to the lake could encounter stocked rainbow trout as well as the other previously established nonnatives present (including channel catfish, green sunfish, largemouth bass, carp, and walleye), and predation may result. The lake rarely spills, (last spill was in 1993) and irrigation releases are during the summer when downstream conditions (high temperatures) would not allow for survival of trout. However, if the lake did spill during spring runoff, stocked rainbow trout could be present during the northern leopard frog breeding season, and depending on the number of trout present, could have adverse effects to recruitment of northern leopard frog in those high precipitation years. Surveys in the spring of 2007 and summer 2009 did not detect rainbow trout below the lake.

## CUMULATIVE EFFECTS

Aside from ongoing actions already discussed, the only change in the operation of Lyman Lake that will occur is due to provisions of the recent Zuni Water Rights Settlement. Future flows in this area may be altered due to water deliveries to Zuni Tribal Lands downstream at and below Zion Reservoir.

### *Non-site specific effects*

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. Transport of the skin fungus *Batrachochytrium dendrobatidis* (*Bd*), the organism that causes chytridiomycosis through the act of stocking sportfish is a considerable concern for the northern leopard frog. AGFD describes those protocols in the BA, and that information is incorporated here by reference. A full discussion on the potential for transporting *Bd* via the sportfish stocking program is included in the Area Wide Analysis section

of this BO.

As described in the Area-Wide analysis, illegal or inadvertent movement of unwanted aquatic organisms (including transmission of diseases and parasites associated with invertebrates, amphibians, or fish) between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. Currently, there is no legal baitfish use in northern leopard frog habitats, although use of tiger salamanders (waterdogs) is allowed. Crayfish may be taken alive from any water and used for bait in that water, but cannot be transported alive away from that water.

## CONCLUSION

After reviewing the current status of northern leopard frog, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the AESO's biological opinion that the sportfish stockings, as proposed, is not likely to jeopardize the continued existence of the northern leopard frog. Because the northern leopard frog is not a listed species, no critical habitat has been designated for this species, therefore, none will be affected.

We present this conclusion on northern leopard frog for the following reasons:

- Although the proposed action at Canyon Diablo and Walnut Creek complexes could have significant adverse effects to northern leopard frog populations extant in that area, the elimination of the Mormon Lake stocking site and the reductions in stocking channel catfish provides a significant area for northern leopard frog persistence in the drainage. Continuation of the stocking program with the warmwater species is likely to reduce the opportunities for northern leopard frog population maintenance and expansion in the action area, which will affect distribution of the species in Arizona.
- The only functioning metapopulation in Arizona at and around Stoneman Lake to the south and west of the action area will not be affected by the stocking program as that site was also dropped from the proposed action.
- Effects to northern leopard frog at Lyman Lake from stocked rainbow trout will likely be limited, as conditions in the lake to support stocking may not occur over the term of this consultation, and that few rainbow trout may access occupied habitats.
- There are additional effects to northern leopard frog due to new stocking sites or species included in the proposed action. As discussed in the Effects of the Action section, these additional effects do not significantly increase the total level of effects from that carried forward by the continuing stocking actions in the proposed action.
- The proposed action contains significant conservation measures to improve the status of northern leopard frog in Arizona.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

### **AMOUNT OR EXTENT OF TAKE**

The prohibitions against taking northern leopard frog found in section 9 of the Act do not apply until the species is listed. In the analysis of effects of the proposed action, we have identified some potential areas where incidental take from the proposed action may occur; however, we are not providing an incidental take statement for this species at this time. The proposed action, through the Conservation and Mitigation Program, is providing conservation measures directed to address potential take that may result from the proposed action. If and when the northern leopard frog is proposed for, and listed under the ESA, we will re-evaluate the effects analysis in this BCO and the implementation of the conservation measures to develop an incidental take statement at that time.

### **Disposition of Dead or Injured Listed Species**

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. In the CAMP included as part of the proposed action for this consultation, AGFD identified a commitment to implementation of the recovery plan or other recovery/conservation strategies for northern leopard frog contingent upon CAMP funding availability as described in the CAMP document. The ability to implement recovery actions for northern leopard frog under the auspices of the CAMP Program provides conservation benefits to northern leopard frog that may not be otherwise realized.
2. As part of the opportunities provided by the CAMP, we recommend AGFD work with the Forest Service and USFWS to eliminate nonnative aquatic species from tanks in the Canyon Diablo, Walnut Creek, and Stoneman Lake population areas to encourage the development of or maintain existing metapopulations.

In order for the AESO to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the AESO requests notification of the implementation of any conservation recommendations.

## **AREA-WIDE SCALE ANALYSIS**

### **Description of the proposed action**

The proposed action is summarized at the beginning of this document (page 6) and fully described in the BA and, for this portion of the consultation, the relevant sections are:

1. Hazard Analysis and Critical Control Point (HACCP) plans for hatchery operations, stocking actions by AGFD, pre-stocking inspection of contracted loads of sportfish from external brokers, and other operational actions by AGFD concerning the deliberate movement of fish within the state.
2. Legal and regulatory framework for use and transport of aquatic species within Arizona. These are summarized in the Fishing Regulations booklet prepared by AGFD (AGFD 2009, 2011)
3. The list of stocking sites and species proposed for stocking.
4. The CAMP.
5. The stocking approach which identifies different prescriptions for stocking for different waters (routine, catastrophic, augmentation, opportunistic etc.)

### **Status of the species and critical habitat (rangewide)**

As described in Appendix A, species under consideration here are those listed in Tables 1-3 of the appendix and include aquatic species (Tables 1 and 3) and terrestrial species (Table 2). Background information on the rangewide status of all these species is provided in the site-

specific analyses for each species or in Appendix E for species where a finding of “may affect, not likely to adversely affect” was made. The relevant portions of the background information are those concerning the effects of nonnative species on the consultation species. Please refer to these other sections of this BCO for that information or citations containing the relevant summaries.

## ENVIRONMENTAL BASELINE [in the action area]

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

### **Description of the Action Area**

The action area for this area-wide scale is defined as all waters in the drainages that are a subset of the Lower Colorado River Basin in Arizona and New Mexico (the Bill Williams River Basin, Gila River Basin, Little Colorado River Basin, Wilcox Playa, and the Havasu Creek sub-basin to the Lower Colorado River). The Gila River Basin includes the Agua Fria, Gila, Salt, San Francisco, San Pedro, and Verde rivers sub-basins. Appendix A discusses the rationale for the selection of these watersheds as the action area for this scale.

#### **A. Status of the species and critical habitat within the action area**

Loss and modification of habitat and the legal and illegal stocking of nonnative aquatic species has had a profound effect on the native invertebrates, fish, frogs, and gartersnakes in Arizona as described in the documents in Appendix D and the individual species site-specific analyses in this BCO. The listing documents, recovery plans, or research papers referenced elsewhere in this BCO clearly connect the declines in native aquatic species to the nonnative species and there is little to no uncertainty that predation, competition, and introduction and dispersal of novel parasites and diseases into Arizona is a dominant factor in the decline of native aquatic species. Many of the nonnative introductions resulted in establishment of self-sustaining populations (Arctic grayling is one of those that did not) in the introduction sites and, as they spread either by illegal transport or hydrological connectivity between the introduction sites and other waters, established self-sustaining populations across the landscape. Not all nonnative species have the same level of impact. The degree to which the nonnative fish, amphibians, and invertebrates affected any particular native species varies with the life history and ecological niche of both native and nonnative species contributing to the resultant effects. Changes to the physical conditions of the native aquatic habitats also influenced the parameters of the interactions, particularly when habitats were simplified and lacked cover or other protective features. Novel parasites or diseases imported with the nonnative species further contributed to declines of native fish and frog species.

For five of the native species (Apache trout, Gila topminnow, Little Colorado spinedace, Page



spring snail, and Three Forks spring snail), their entire currently occupied range is the action area. For the remaining species, occupied habitat is also in adjoining states and/or in Mexico. Designated or proposed critical habitat within the action area exists for 10 species (loach minnow and spikedace have both designated and proposed critical habitat). All designated or proposed critical habitat contains or implies at least one PBF identifying the presence of nonnative species in the critical habitat as a concern for the value of that habitat for conservation of the species. Most, if not all, the designated critical habitat reaches already contain nonnative aquatic species (the exception being critical habitat for the Quitobaquito pupfish). The need for special management actions to address the presence of nonnative aquatic species in critical habitat is identified in the critical habitat designations.

## **B. Factors affecting the species' environment and critical habitat within the action area**

There are numerous effects to the consultation species and their critical habitat across the action area. Land management activities such as timber harvest, improper livestock grazing, and recreation; development of urban, suburban, and rural residential, commercial, industrial, and infrastructure projects; water development projects including surface water uses with associated dams and diversions, groundwater pumping, and channelization or infilling of wetlands; and other human activities on the land have significant adverse effects to the extent and physical conditions of habitat for the consultation species. These effects are documented in a variety of sources for each species, including listing documents, recovery plans, and biological opinions. Please refer to background information in the individual species site-specific portion of this BCO for citations that contain information on these effects.

### *Introduction of unwanted aquatic organisms*

There are two primary pathways for fish species to be introduced to the landscape. Authorized (legal) introductions of nonnative fish are likely the primary pathway for the initial introduction of nonnative fish to a new area (Kerr et al 2005). Legal pathways for nonnative fish introductions include stocking activities authorized by Federal, state, local and tribal governments, as well as by private citizens (e.g. stock ponds) or businesses (e.g. vegetation control for irrigation canals) that acquired a stocking permit for waters on privately-owned land, if warranted (regulations described above under #2 above). These introductions may involve one or many sites and were generally intended to introduce that species for a particular purpose at the site (aquatic weed control, human consumption, recreational opportunities). Once introduced and established, hydrological connectivity among waters became a pathway for movement away from the stocking site leading to the potential movement of species into areas where they weren't purposefully stocked. Legal stocking actions also contributed to the illegal movement of fish by persons unknown from authorized stocking sites to other sites where they were not stocked or could not reach on their own.

The second pathway for introductions is the illegal introduction of fish species. These types of introductions typically result from the release of fish into the wild from the baitfish industry, recreational anglers, ornamental ponds and aquaria, private aquaculture, live food fish, uninformed members of the public, and commercial shipping. Such actions may be intentional or unintentional. Although state and Federal laws prohibit illegal introductions of wildlife and

have been in effect for decades, illegal introductions have occurred historically and continue through a multitude of pathways (see for example Marsh and Minckley 1982, Courtenay and Taylor 1986, Whittier and Kincaid 1999, Schade and Bonar 2005, Kerr et al 2006, Marchetti et al 2006).

Past events (both legal and illegal) resulted in the establishment of at least 60 nonnative fish species, at least three nonnative amphibians (American bullfrog, Rio Grande leopard frog, American tiger salamander), at least four invertebrates (two species of crayfish, Asiatic clam, and New Zealand mud snail), and several diseases or parasites that affect native fish or amphibians in areas across Arizona. Additional nonnative species currently have more limited distributions in the state. The 2002 Background document for the Central Arizona Project biological opinion (USFWS 2002a) contains a detailed discussion of the introduction of nonnative species into Arizona and the pathways by which unwanted aquatic organisms are introduced and move away from initial introduction sites.

At least 60 species of nonnative fish have been introduced into Arizona primarily through authorized stockings by the AGFD or the Federal government (Table 34). All but three of these introductions occurred prior to 1975; with some occurring prior to 1900. Of these, 19 (30%) were likely unauthorized or unintentional introductions, primarily from releases of baitfish, or fish from aquaria or ornamental ponds. Of the total, 29 species are considered sportfish and were stocked primarily between 1925 and 1950, corresponding to an era where fish were stocked across North America to provide food (see “Fish hatcheries and stocking practices”). These fish may have been stocked by the U.S. Commission of Fish and Fisheries (USFC in the table below), but there is no documentation as such. Table 35 lists the other nonnative fish species documented in Arizona.

Table 34: Nonnative sportfish species introduced into Arizona

| Common name                                  | Scientific name               | 1 <sup>st</sup> stocked or documented | Source (Original) | Established in Arizona? |
|----------------------------------------------|-------------------------------|---------------------------------------|-------------------|-------------------------|
| <i>Coldwater sportfish</i>                   |                               |                                       |                   |                         |
| Arctic grayling                              | <i>Thymallus arcticus</i>     | 1939                                  | USFC              | Not reproducing         |
| Brook trout                                  | <i>Salvelinus fontinalis</i>  | 1902                                  | USFC              | Yes                     |
| Brown trout                                  | <i>Salmo trutta</i>           | 1924                                  | USFC              | Yes                     |
| Coho salmon                                  | <i>Oncorhynchus kisutch</i>   | 1960s                                 | AGFD?             | No                      |
| Cutthroat trout                              | <i>Oncorhynchus clarki</i>    | 1899                                  | USFC              | Not reproducing         |
| Kokanee                                      | <i>Oncorhynchus nerka</i>     | 1957                                  | AGFD              | No                      |
| Rainbow trout                                | <i>Oncorhynchus mykiss</i>    | 1897                                  | USFC              | Yes                     |
| <i>Warmwater sportfish: bass and sunfish</i> |                               |                                       |                   |                         |
| Bluegill                                     | <i>Lepomis macrochirus</i>    | 1931                                  | USFC              | Yes                     |
| Black crappie                                | <i>Pomoxis nigromaculatus</i> | 1902                                  | USFC              | Yes                     |

|                              |                                |      |                          |                     |
|------------------------------|--------------------------------|------|--------------------------|---------------------|
| Green sunfish                | <i>Lepomis cyanellus</i>       | 1925 | USFC                     | Yes                 |
| Largemouth bass              | <i>Micropterus salmoides</i>   | 1896 | USFC                     | Yes                 |
| Pumpkinseed sunfish          | <i>Lepomis gibbosus</i>        | ?    | Unknown                  | No                  |
| Redear sunfish               | <i>Lepomis microlophus</i>     | 1948 | AGFD                     | Yes                 |
| Rock bass                    | <i>Ambloplites rupestris</i>   | 1896 | USFC                     | Locally established |
| Smallmouth bass              | <i>Micropterus dolomieu</i>    | 1929 | USFC                     | Yes                 |
| Spotted bass                 | <i>Micropterus punctulatus</i> | 1941 | AGFD                     | Locally established |
| Striped bass                 | <i>Morone saxatilis</i>        | 1969 | AGFD                     | Locally established |
| Sunfish hybrid               | <i>Lepomis spp x Lepomis</i>   | 2008 | Commercial               | Locally established |
| Warmouth                     | <i>Chaenobryttus gulosos</i>   | ?    | Accidental via stocking? | Locally established |
| White bass                   | <i>Morone chrysops</i>         | 1951 | AGFD                     | Locally established |
| White crappie                | <i>Pomoxis annularis</i>       | 1902 | USFC                     | Locally established |
| Yellow bass                  | <i>Morone mississippiensis</i> | 1929 | USFC                     | Locally established |
| Warmwater sportfish: catfish |                                |      |                          |                     |
| Black bullhead               | <i>Ameiurus melas</i>          | 1919 | USFC                     | Yes                 |
| Brown bullhead               | <i>Ameiurus nebulosus</i>      | 1935 | USFC                     | No?                 |
| Blue catfish                 | <i>Ictalurus furcatus</i>      | 1970 | AGFD                     | No                  |
| Channel catfish              | <i>Ictalurus punctatus</i>     | 1904 | USFC                     | Yes                 |
| Flathead catfish             | <i>Pylodictis olivaris</i>     | 1940 | Unknown                  | Yes                 |
| Yellow bullhead              | <i>Ameiurus natalis</i>        | ?    | ?                        | Yes                 |
| Warmwater sportfish: other   |                                |      |                          |                     |
| Muskie                       | <i>Esox masquinongy</i>        | 1975 | AGFD                     | No                  |
| Northern pike                | <i>Esox lucius</i>             | 1965 | USFWS                    | Locally established |
| Walleye                      | <i>Sander vitreus</i>          | 1960 | AGFD                     | May reproduce       |
| Yellow perch                 | <i>Perca flavescens</i>        | 1918 | USFC                     | Locally established |

Table 35: Nonnative fish not stocked as sportfish

| Common name | Scientific name | 1 <sup>st</sup> stocked or documented | Source | Established in Arizona? |
|-------------|-----------------|---------------------------------------|--------|-------------------------|
|-------------|-----------------|---------------------------------------|--------|-------------------------|

|                                         |                                    |         |                                     |                       |
|-----------------------------------------|------------------------------------|---------|-------------------------------------|-----------------------|
| <i>Baitfish species</i>                 |                                    |         |                                     |                       |
| Golden shiner                           | <i>Notemigonus crysoleucas</i>     | 1929    | USFC                                | Yes                   |
| Fathead minnow                          | <i>Pimephales promelas</i>         | 1950    | Unknown                             | Yes                   |
| Red shiner                              | <i>Cyprinella lutrensis</i>        | 1948    | Unknown                             | Yes                   |
| Threadfin shad                          | <i>Dorosoma petenense</i>          | 1955    | AGFD                                | Yes                   |
| <i>Miscellaneous species</i>            |                                    |         |                                     |                       |
| Alligator gar                           | <i>Atractosteus spatulata</i>      | ?       | ?                                   | No                    |
| American shad                           | <i>Alosa sapidissima</i>           | 1883    | USFC                                | No                    |
| Bairdiella                              | <i>Bairdiella icistia</i>          | 1967    | AGFD                                | No                    |
| Bigmouth buffalo                        | <i>Ictiobus cyprinellus</i>        | 1917    | USFC                                | Locally established   |
| Black buffalo                           | <i>Ictiobus niger</i>              | 1917    | USFC                                | Locally established   |
| Blue tilapia                            | <i>Oreochromis aureus</i>          | 1975    | AGFD                                | Yes                   |
| Common carp                             | <i>Cyprinus carpio</i>             | 1880    | USFC                                | Yes                   |
| Convict cichlid                         | <i>Archocentrus nigrofasciatus</i> | 1960s   | Aquarium?                           | No                    |
| Gizzard shad                            | <i>Dorosoma cepedianum</i>         | 2004?   | Accidental via stocking             | Locally established   |
| Goldfish                                | <i>Carassius auratus</i>           | By 1939 | Unknown                             | Limited reproduction  |
| Green swordtail                         | <i>Xiphophorus helleri</i>         | ?       | Aquarium                            | No                    |
| Guppy                                   | <i>Poecilia reticulata</i>         | ?       | Aquarium                            | No                    |
| Inland silverside                       | <i>Menidia beryllina</i>           | 2000s   | Bait dealer or via bilge water      | Yes                   |
| Mexican shortfin molly                  | <i>Poecilia mexicana</i>           | ?       | ?                                   | Limited establishment |
| Mexican tetra                           | <i>Astyanax mexicanus</i>          | 1950s   | Bait dealer                         | No                    |
| Mosquitofish                            | <i>Gambusia affinis</i>            | 1925    | Unknown                             | Yes                   |
| Mozambique tilapia                      | <i>Oreochromis mossabicus</i>      | 1959    | Unknown                             | Yes                   |
| Orangemouth corvina                     | <i>Cynoscion xanthulus</i>         | 1967    | AGFD                                | No                    |
| Redbelly tilapia                        | <i>Tilapia zilli</i>               | 1968    | U of Arizona                        | Yes                   |
| Redside shiner                          | <i>Richarsonius balteatus</i>      | 1948    | Bait dealer                         | Limited establishment |
| Rio Grande killifish (plains killifish) | <i>Plancterus zebrinus</i>         | 1937    | Accidental via stocking/bait dealer | Limited establishment |

|                    |                                |       |             |                     |
|--------------------|--------------------------------|-------|-------------|---------------------|
| Sacramento perch   | <i>Archoplites interruptus</i> | 1968  | Unknown     | No                  |
| Sailfin molly      | <i>Poecilia latipinna</i>      | 1950s | Bait dealer | Locally established |
| Sargo              | <i>Anisotremus davidsoni</i>   | 1967  | AGFD        | No                  |
| Smallmouth buffalo | <i>Ictiobus bubalus</i>        | 1918  | USFC        | Locally established |
| Variable platyfish | <i>Xiphophorus variatus</i>    | 1960s | Aquarium?   | No                  |
| White sturgeon     | <i>Acipenser transmontanus</i> | 1967  | AGFD        | No                  |

Bullfrogs were deliberately introduced into Arizona beginning in 1926 by the Arizona State Game Department (now AGFD) to create populations for hunting. Initial introductions were in the Salt River near Phoenix and were very successful. AGFD continued introducing bullfrogs into the state, and from 1967-1982 stocked more than 682,000 tadpoles into streams throughout the state. Private individuals also contributed to introductions in lakes, stock tanks, and other sites (Tellman 2002). Bullfrogs are distributed across the action area in most suitable habitats.

Arizona is one of only a few states with no native crayfish species. Crayfish (*Oronectes virilis* and *Procamberus clarki*) were also deliberately introduced by AGFD and FWS approximately 30 years ago to control aquatic vegetation and provide forage for stocked sportfish (Inman et al. 1998). Crayfish spread rapidly from stocking sites through connected waters and via bait-bucket transport. Crayfish are distributed across the action area in most suitable habitats.

New Zealand mud snails (*Potamopyrgus antipodarum*) were introduced to North America likely via ballast water from ships arriving from contaminated areas; however, their spread away from the Great Lakes and the West Coast of the United States is more problematic, and may be related to transport of individuals on wet aquatic gear, boats, waders, or other equipment (Sorensen 2010). They are currently found only in the mainstem Colorado River above Hoover Dam, and not elsewhere in the action area.

Disease and parasites are additional threats to native fish populations, and these can be introduced incidentally with the spread of nonnative species. Transmission may occur via introduced fish species, and bait species used for angling. Such species include fish, crayfish, and waterdogs (tiger salamanders). Asian tapeworm, introduced from Asia through grass carp (also known as white amur) introductions was first documented in the Virgin River basin in 1979 (Heckmann et al. 1986), probably carried there by red shiner. It appeared in the Little Colorado River in Grand Canyon by 1990 (Clarkson et al. 1997), and was found in the Gila River Basin on the Gila River near Ashurst-Hayden Dam in both carp and red shiner (USFWS 2002a). Cyprinid fishes are a definitive host of Asian tapeworm; so many native species in Arizona are at risk. Anchor worm originated in Asia and was spread in the United States through the trade in goldfish (Hoffman and Schubert 1984). This parasite is now widespread in the Colorado and Gila River basins and is affecting a number of native fish species (Wilson et al. 1966, Robinson et al. 1998, Weedman et al. 1996). Anchor worm can be spread by stocking infected fish (Hart 1999). Ich is a widespread parasite of fish that often occurs in hatchery fish populations and is also found in the wild. Both of these parasites can adversely affect native fish. Susceptibility and

concomitant impacts of disease and parasites may be exacerbated by stress due to habitat degradation and habitat loss.

The chytridiomycete skin fungus, *Batrachochytrium dendrobatidis* (*Bd*), the organism that causes chytridiomycosis, is responsible for global declines of frogs, toads, and salamanders (Berger et al. 1998, Longcore et al. 1999, Speare and Berger 2000, Hale 2001) (see Appendix D for a full discussion of this pathogen). This is a recently emerged pathogen that has spread widely across the world. Weldon et al. (2004) suggest that Africa is where the disease originated and that international trade in African clawed frogs was the means of disease dissemination outside of Africa. African clawed frogs were widely exported from Africa beginning in the 1930's, and escaped individuals have established populations in several areas, including Arizona. Any infected frogs exposed to other frogs or tiger salamanders could transmit *Bd* into wild populations of those species. Natural or human-assisted dispersal of infected bullfrogs or tiger salamanders likely contributed to the spread of the pathogen.

AGFD has *Bd*-positive records for amphibians occurring in the following river systems in the action area: Agua Fria (Lake Pleasant), San Francisco, Gila (tributary to mainstem), Hassayampa, Salt, San Pedro, Santa Cruz, and Verde (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007).

Another pathogen of concern for native amphibians is *Ambystoma tigrinum* virus (ATV) that kills Sonoran tiger salamanders. ATV is an emerging pathogen (Storfer 2003), and genetic analysis suggests a single introduction and recent spread over a large geographic area from Arizona to Saskatchewan (Jancovich et al. 2005). ATV may have switched from sportfishes to salamanders or was introduced with water dogs (another subspecies of tiger salamander [*A. m. mavortium*] used in the bait industry) imported for use as fish bait in Arizona and elsewhere (Jancovich et al. 2005). Collins et al. (2003) identified ATV in waterdogs obtained from a Phoenix bait shop. Anyone with a valid Arizona fishing license can import, transport, or possess live tiger salamanders except in a portion of the state in Santa Cruz County. The spread of ATV across Arizona could also be the result of other vectors beside imported tiger salamanders. Animals that survive ATV exposure may harbor transmissible infection for more than six months. Dispersing metamorphosed salamanders have been found carrying ATV, and when they return to a pond to breed, may reinfect the aquatic population (Collins et al. 2003). The disease could be spread by researchers or anglers if equipment such as waders, nets, or fishing tackle used at a salamander tank are not allowed to dry or are not disinfected before use at another tank. Continuing illegal use of nonnative tiger salamanders at Parker Canyon Lake remains a primary threat for both introgression and disease transmission (USFWS 2007a).

### *Conservation actions*

Organized and funded conservation programs that address effects to some of the consultation species are being implemented in Arizona. These programs are the result of significant effects to species by Federal or non-Federal actions (Gila River Basin Native Fishes Conservation Program, Horseshoe-Bartlett Reservoir Habitat Conservation Plan [HCP], Lower Colorado River Multi-Species Conservation Program) or smaller HCPs for private actions (San Rafael Cattle Company Draft HCP and Malpai Borderlands HCP). The Arizona Statewide Conservation

Agreement (AGFD 2006) contains conservation actions for the headwater chub and roundtail chub; however, there is no dedicated funding source to implement the projects in the agreement. Other voluntary conservation programs include efforts by the Gartersnake Conservation Working Group and the East Clear Creek Watershed group. Through efforts of their Nongame and Research branches, Native Trout Program, the Heritage Grant and Land Acquisition programs, collaboration with and funding of educational research programs (e.g. Arizona State University, Northern Arizona University and University of Arizona, etc.), AGFD contributes significant effort from its own resources to provide conservation for consultation species. They also have ownership of Safe Harbor Agreements for the Chiricahua leopard frog, desert pupfish, and Gila topminnow to facilitate reestablishment of populations of these species on private lands.

Other conservation for consultation species is accomplished by Native American Tribes (particularly the WMAT for Apache trout), other Federal agencies such as the U.S. Forest Service and Bureau of Land Management, and conservation organizations such as The Nature Conservancy and the National Fish and Wildlife Foundation. The USFWS also provides on-the-ground conservation benefits for consultation species through grant programs such as Partners for Wildlife.

#### *Climate change*

Arizona is experiencing a long-term drought that has significant adverse effects to aquatic habitats and the consultation species that rely on them. Philips and Thomas (2005) provided streamflow records that indicate that the drought Arizona experienced between 1999 and 2004 was the worst drought since the early 1940s and possibly earlier. The Arizona Drought Preparedness Plan Monitoring Technical Committee (ADPPMTC) (2008) assessed Arizona's drought status through June 2008 in watersheds where the headwater chub occurs or historically occurred. They found that the Verde and San Pedro watersheds continue to experience moderate drought (ADPPMTC 2008), and the Salt, Upper Gila, Lower Gila, and Lower Colorado watersheds were abnormally dry (ADPPMTC 2008).

The ongoing drought conditions have depleted recharge of aquifers and decreased baseflows in streams and rivers in the state. Even in years with periods of high precipitation, the amount of recharge and effects to baseflows is of limited effect, particularly if the precipitation has little time to soak into the ground and instead runs off as sheet flow and causes flooding. In streams that depend on the shallow aquifer for baseflows, summer flows may already be low and available habitat only in intermittent reaches. These habitats are already subject to high temperatures and declining water quality from evaporation exceeding inflow, and any reductions in inflow could be significant for survival of the individuals in these habitats.

Further exacerbating the effects of drought on streamflows is the continuing and expanding use of groundwater from aquifers that support springs or surface flows in the headwater streams. Groundwater pumping results in cones of depression in groundwater levels in the aquifers that are already under stress from reduced natural recharge. On streams where there is both groundwater use and surface diversions, the reduction in baseflows to support aquatic species is particularly damaging. Under normal streamflow conditions, there may be sufficient flow to support surface diversions without drying the stream but that may not be the case when flows are

lower and water rights holders divert all or most of the existing flow. Since surface diversions are more likely to be for agriculture, their highest use is also during the irrigation season (generally May through September) when baseflows are lowest.

Drought also adversely affects isolated ponds and stock tanks that support native leopard frogs and tiger salamanders. Most of these habitats are maintained by precipitation events and are used as livestock waters. Drying of smaller ponds and tanks is a regular occurrence even under normal conditions; under drought conditions, larger tanks that were historically more permanent are at greater risk of becoming uninhabitable. Where the distance between occupied ponds or tanks that are at risk of drying to more permanent waters are within the dispersal ability of the native amphibians, individuals can move to the new habitat.

The aquatic habitat areas most likely to remain suitable during drought conditions are generally those lower in the watershed (and thus supported by a greater drainage area) or supported by active management such as groundwater pumping or releases from large reservoirs. The more permanent the habitat is, the more likely it is populated by nonnative predators that often precludes the establishment of the native species. Thus, the current situation favors nonnative species over the native species as the latter are more likely to have populations in aquatic habitats at greater risk from drought than the former.

### *Summary*

The status of the consultation species in the action area is the result of the aggregate effects of past and ongoing actions that have affected, both positively and negatively, individuals of the species and their habitats. Physical and biological changes to habitats have been significant for most species and resulted in significant reductions in occupied range for most species, and those changes have largely been resistant to restoration activities.

## EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

### **Illegal and inadvertent transport of unwanted aquatic organisms**

The illegal and inadvertent transport of unwanted aquatic organisms results in the presence of potential competitors and predators in consultation species habitats and the transmission of diseases and parasites. The subset of this activity as it relates to the proposed action is analyzed here. Effects of the stocked sportfish species on consultation species are discussed in Appendix D and in documents cited in the individual species site-specific analyses and the effects are the same as for this component of the consultation. Effects to PBFs of critical habitat are also the



same as discussed previously under the species analyses section.

The following discussions utilize portions of the BA developed as part of the consultation package and are included in the BCO as Appendix D. These documents include a review of diseases and parasites associated with hatcheries in Arizona, and a review of chytridiomycosis (the disease caused by *Bd*). We include the texts of these documents in this BCO by reference. Additionally, we include our 2002 Background Document for the CAP (USFWS 2002a) for its extensive discussion of transport pathways for unwanted aquatic organisms.

As part of the analysis, we also include measures within the proposed action or operational protocols which are in place to reduce the risk of illegal or inadvertent transport of unwanted aquatic organisms.

#### Potential routes for transport

There are several routes available for transport of unwanted aquatic organisms that are relevant to the proposed action, including:

1. Accidental transport into hatcheries in Arizona through importation of eggs or fry for rearing to stock under the proposed action, then dispersal from the hatchery in the stocked fish or transport system. (Direct effect)
2. Presence of non-target organisms in the watershed surrounding the hatchery such that the fish raised in the hatchery are exposed and the organism is dispersed from the hatchery to other watersheds in the stocked fish or transport system. (Direct effect)
3. Inadvertent introduction of unwanted aquatic organisms through imported sportfish for stocking or as live bait to be sold in Arizona. (Direct and indirect effects)
4. Transfer of unwanted aquatic organisms between stocking sites in different drainages due to survey or other monitoring actions associated with sportfish stocking or if sportfish are moved by AGFD personnel as part of management actions to augment populations. (Indirect effect)
5. Inadvertent transfer of unwanted aquatic organisms present in the stocking site as a result of the proposed action on boats and other gear owned by anglers moving between stocking sites or to other waters of Arizona from stocking sites. (Indirect effect)
6. Deliberate, illegal movement of stocked sportfish or their progeny, baitfish, or other unwanted aquatic organisms from stocking sites to other waters of Arizona by anglers who pursue stocked sportfish or their progeny or by persons to create sources of these species to market to anglers pursuing stocked sportfish or their progeny. (Indirect effect)
7. Deliberate, illegal movement stocked sportfish or their progeny or other unwanted aquatic organisms present as a result of the proposed action from stocking sites to other waters of Arizona by members of the public who are not anglers. (Interrelated action)

It is important to consider that the accidental introductions of unwanted aquatic organisms via Routes 1-7 are directly and wholly connected to the proposed action. While there are protocols in place to reduce the risk of introductions by Routes 1-4, these events have occurred in the past and are likely to occur in the future. Routes 6 and 7 are illegal, difficult to control, and happen on a repeating basis. Route 5 is connected to the proposed action through exposure of the angler or other recreationist to the unwanted aquatic organism while fishing or engaging in water sports

in locations where stocked sportfish or their progeny may be found. It is also important to understand that impacts similar to those from Routes 3, 5, 6, and 7 are also the result of sportfishing and other water-related activities that are not associated with the proposed action. These effects are both part of the environmental baseline, and continue into the future as cumulative effects. They are discussed under cumulative effects.

#### Route 1: Importation to hatcheries

AGFD obtains fertilized eggs or fry of Arctic grayling and nonnative trout species from private, state, or Federal hatcheries outside of Arizona and fertilized eggs of Apache trout from the Alchey-Williams Creek National Fish Hatchery Complex in Whiteriver, Arizona. These eggs or fry are reared in the state hatcheries (Canyon Creek, Page Springs, Pinetop, Silver Creek, Sterling Springs, and Tonto Creek) for release into coldwater stocking sites as part of the proposed action.

All hatcheries engaged in fish production are subject to numerous requirements to maintain the facility free of fish diseases. Management of fish hatcheries is a complex undertaking that involves implementation of various HACCP plans to maintain disease-free certifications. Broodstock hatcheries that produce eggs and fry for export maintain their adult spawners in ponds, raceways, or other facilities. Once spawning is initiated, the eggs and fry are kept in secure conditions and are not exposed to outside vectors. HACCP protocols for transport of the eggs or fry also reduce the risk of inadvertent transport of unwanted aquatic organisms, particularly disease vectors. While this route may historically have been responsible for inadvertent introduction of unwanted aquatic organisms, due to more stringent health inspections and precautionary treatments, it is less likely that any introductions via this route would occur over the consultation period. Further, if disease is detected during normal monitoring of eggs, fry, or juvenile fish during the rearing process, treatment of the disease would occur at the hatchery. The success of such treatment would determine the eventual fate of the infected fish.

To prevent the spread of pathogens, AGFD follows the same protocols for fish health inspection as the USFWS National Fish Hatcheries and the USFWS Fish Health Centers: the American Fisheries Society Fish Health Section Blue Book co-authored by the USFWS (AFS-FHS 2007). Hatcheries providing eggs to AGFD hatcheries must also follow these protocols. This handbook reflects the combined efforts and expertise of the USFWS Fish Health Centers and the American Fisheries Society Fish Health Section. It has been assembled by a vast array of individuals with academic and field expertise. It is a compilation of methodologies determined to be most appropriate for detecting the presence of specific pathogens during an aquatic animal health inspection. The methodologies are based on numerous sources, including the USFWS National Wild Fish Health Survey Manual, the American Fisheries Society Blue Book, 5th edition of the Office International des Epizooties (OIE) Manual of Diagnostic Tests for Aquatic Animals, Alaska Department of Fish and Game, Fish Pathology Section Laboratory Manual, and peer reviewed literature.

The AGFD HACCP plan complies with international standard (ASTM E2590 - 09) for reducing or eliminating the spread of unwanted species. The HACCP was developed as an effective planning tool for creating best management practices to prevent the spread of non-target species.

The USFWS, AGFD, and State of Wyoming Game and Fish Department worked together to develop the HACCP Planning for Natural Resource Pathways manual keyed to the operations and activities associated with natural-resource management and aquatic-resource propagation (USFWS 2004). This tool provides a comprehensive method to identify risks and focus procedures to prevent the spread of species through natural-resource pathways.

### Summary

Based on this information, we believe the risk of the spread of parasites or diseases through importation of eggs or fry to Arizona hatcheries is adequately addressed by HACCP and other operational protocols for disease transmission and the risk of effects to consultation species is low.

### Route 2: Contamination in the hatchery

There are no instances of stockings from Arizona hatcheries inadvertently transporting fish species other than the intended sportfish species to stocking sites. The concern here is for other organisms that may infiltrate the hatchery.

Organisms in the watershed may move into hatcheries, particularly those that use ponds or other outside rearing facilities. Where sportfish for stocking are raised in open (natural) ponds or earthen raceways, they can be exposed to unwanted aquatic organisms carried into the water by birds, amphibians, or mammals such as otters. If the ponds contain nonnative fish or bullfrogs, those can be hosts to parasites or diseases that then may transfer to the sportfish.

As discussed under Route 1, AGFD hatcheries follow established protocols to reduce or eliminate the spread of unwanted aquatic species. These protocols address the risk of transport of New Zealand mud snail in coldwater sportfish stockings in the Black River drainage to minimize effects to Three Forks springsnail.

Of the state hatcheries involved in fish production for stocking purposes, none uses outdoor ponds where nonnative bullfrogs may be in contact with sportfish. Silver Creek has an open (unsecured) water supply and does use outdoor raceways; however, there is limited to no habitat for frogs in those open waters as they are flow-through systems without ponded water areas, so risk of contamination by *Bd*-infected bullfrogs at that site is low. Page Springs has some risk of contamination due to the current water-supply delivery system, which comes from two springs, only one of which is secured (closed); however, the limited time the water is not secured is small and the rainbow trout are raised in indoor raceways where any bullfrogs would be immediately apparent. Sterling Springs (which hatches eggs for the other hatcheries), Canyon Creek, and Tonto Creek have secured water supplies that are closed systems and trout are raised indoors in raceways. Both Canyon Creek and Tonto Creek raise “incentive fish” (larger trout for stocking) in an outdoor “show pond” and these fish are infrequently stocked to encourage anglers or may be used for display or expositions.

### Summary

Based on this information, we believe the risks of *Bd* transmission from the coldwater hatchery stockings are negligible and those from any warmwater stockings are low. Please review the discussion of chytridiomycosis vectors and diseases and parasites included in Appendix D.

### Route 3: Contaminated stocking or live bait loads from outside Arizona

#### *Stocked sportfish*

Transportation of sportfish from hatcheries outside of Arizona to wild sites has the potential to move non-target plants, mollusks, amphibians, diseases, and parasites with the fish. Bullhead catfish and some of the sunfishes likely were introduced unintentionally to the Southwest with stocks of more desirable sportfishes (Minckley and Marsh 2009). Pittman (2003) summarized some of the history of inadvertent introductions of nontarget fish species during stocking events.

The introduction of gizzard shad into Lake Powell is an example of this route. In 1998, gizzard shad were introduced into Morgan Lake on the Navajo Nation in New Mexico with a stocking of largemouth bass from Inks Dam National Fish Hatchery in Texas. The water supply for Inks Dam is surface water, and gizzard shad are present. Subsequent stocking loads were rejected due to contamination with other fish species, including Guadalupe bass, white bass, bluegill, dollar sunfish, and logperch; however, the gizzard shad became established in the lake. No renovation of the lake to remove the gizzard shad was attempted. In 2002, gizzard shad were detected in the San Juan arm of Lake Powell (Morgan Lake is in the San Juan drainage) and very quickly established themselves in the lake and are moving downstream in the Colorado River (Mueller and Brooks 2004). Gizzard shad appeared in Roosevelt Lake on the Salt River in 2007, and were established by 2008. The vector for gizzard shad appearing in Roosevelt Lake is unclear; however, the introduction may also have been associated with warmwater fish stocking by Federal hatcheries in the Salt River drainage.

Dodd and Barichivich (2007) found evidence of inadvertent movement of bullfrog tadpoles with warm water fishes to Harris Neck National Wildlife Refuge, Georgia. Platz et al. (1990) indicated the most likely way that Rio Grande leopard frogs arrived in Arizona was via unintentional transport with warm water fishes from a hatchery in New Mexico. Presence of Plains leopard frogs (*Lithobates blairi*) well outside of their range at the Utah State Fish Hatchery near Glen Canyon City is also likely the result of inadvertent transport with fish stocks. Green and Dodd (2007) also documented *Bd* and amphibian microsporidian and myxozoan parasites in bullfrog tadpoles at four warmwater hatcheries in the southeastern U.S., which were likely moved inadvertently with stocks of hatchery fishes transported to stocking sites across the region.

Incidents such as Morgan Lake prompted the development of increased controls on inter-state shipments of hatchery-reared sportfish for stocking. For example, Inks Dam National Fish Hatchery now has HACCP plans in place to reduce the opportunity for transfer of unwanted aquatic organisms during stocking actions (USFWS undated). Inter-state transport by commercial aquaculturists of warmwater fish species destined for stocking in Arizona must also comply with inter-state rules, regulations, and requirements of the receiving state for disease certifications and the presence of fish or amphibian species contaminating the load. It is in the

best interests of the commercial producer to work to meet those standards, otherwise their business would be at risk. Responsible producers understand the need for these restrictions. AGFD has a standard protocol for inspecting such loads prior to them being stocked into a site, and while this inspection is not an absolute protection against the inadvertent introduction of an unwanted aquatic organism, it does act to reduce the risk. Further, as a conservation measure, AGFD is including an enhanced two-inspection program for imported warmwater fish loads destined for stocking sites with concerns for introduction of nonnative frogs or transmission of *Bd* to Chiricahua leopard frog and northern leopard frog habitats. The enhanced program has two sorting inspections instead of one to more fully examine the entire load for individuals or unwanted aquatic species. This inspection may not address the transport of zoospores of *Bd* from out of state hatcheries where this pathogen is known to occur (Green and Dodd 2007).

### *Live bait species*

The live baitfish industry got its start in the 1930s through concerns by fisheries managers that the removal of baitfish from donor waters would have impacts to the forage base for sportfish species inhabiting donor waters. The commercial baitfish industry that developed was based on the public's desire for convenience in acquiring live bait. Thus, the culture of baitfish species began across the US and Canada and bait restrictions followed. Conversely and some years later, there were also concerns about recipient waters and the potential impacts of introducing nonnative fish to the ecosystem including disease, displacement of other fishes, and changes in food-web dynamics. These concerns brought the need for regulations to protect existing native species and their habitats, and prompted stricter live baitfish regulations to prohibit the release and transport of baitfish species

### *Live baitfish*

Live baitfish were first prohibited for use in Arizona as early 1947 in all lakes in Coconino County, several lakes in Apache and Graham counties, as well as in the Agua Fria River, Lake Pleasant, and any lake in the state containing protected trout. Additionally, goldfish were prohibited as live bait in the Colorado River along the Arizona/California border in the 1950 fishing regulations. Beginning in 1952, the use of live bait was prohibited in all waters of the state containing trout, except for the Colorado River. Finally in 1959, fishing regulations specified that fathead minnow, threadfin shad, red shiner, and mosquitofish were legally authorized for use as live bait in approved locations (per ARS R12-4-305). The fish may be purchased from licensed bait dealers or captured wild and used at the capture sites. Live baitfish imported from outside the state must pass fish health regulations prior to entering the state.

Live bait species may be released by bait producers and dealers, either through accidental escape or by illegal dumping of unwanted stock. In addition to the species being produced and used as bait, others are sometimes introduced through accidental inclusion in shipments of bait species (Carlton 1992). In a study in North Dakota and Minnesota, 28.5% of the bait purchases from commercial dealers contained fish species that were not legal baitfish (Ludwig and Leitch 1996) for the receiving waters. Fish and amphibian diseases or parasites can be transported to Arizona via imported baitfish. Over the past 70 years, only three species of fish found to be in Arizona illegally are thought to be attributable to the baitfish industry and the use of live baitfish. These

include inland silverside (2007), redbreasted sunfish (1948), and Rio Grande killifish (1937).

### Tiger salamanders

Imported tiger salamanders are often used as live bait for largemouth bass and channel catfish, and this trade in wildlife has resulted in the introduction of this species across the west (Johnson et al. 2009). Introgression with native Sonoran tiger salamanders and conveyance of the ATV virus is a significant concern for that species (see individual species site-specific analysis) and these nonnatives can also carry other diseases. Tiger salamanders are also potential predators on small fish and tadpoles, so they can have adverse effects to native fish and ranid frog populations.

Under current regulations, commercial bait dealers are not allowed to collect tiger salamanders from the wild in Arizona to sell. All tiger salamanders in bait shops must be imported from other states where they are either collected from the wild or from developed source populations. There are fish health standards for baitfish species imported into Arizona, but the regulations are silent on tiger salamanders due to a lack of established standard protocols for collection and analysis of *Bd* and ATV. Once industry protocols are developed, the current regulatory framework can require testing. Without health inspections, infected animals are generally not detected and this route of introduction is of particular concern for the Sonoran tiger salamander for ATV and Chiricahua and northern leopard frogs for *Bd*.

*Bd* does not cause disease in tiger salamanders; however infected animals can carry the zoospores. In a study that focused primarily on ranavirus screening, Picco and Collins (2008) tested whether the bait trade in larval tiger salamanders (waterdogs) in Arizona facilitated the dispersal of *Bd*. They used real-time testing to screen water samples and to test salamander tissue samples from 9 bait shops that sold waterdogs. They reported positive results for *Bd* from water samples from three of the nine shops, and *Bd*-positive tissue from one of those 3 shops. One out of 24 shops (4%) sampled in the entire study released unsold tiger salamanders into the wild after they had been kept in shops with *Bd*- or ranavirus-infected animals. Picco et al. (2010) determined that infected tiger salamanders could infect largemouth bass with *Bd*, thus allowing the disease vector to remain hidden in the system once the salamanders were released.

As conservation measures, AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend bait management. These recommendations will be presented to the Arizona Game and Fish Commission (AGFC) for implementation consideration. A review and update of existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species is also planned.

### Summary

Based on this information, we believe that there remains a risk of introduction of unwanted aquatic organisms to Arizona or to new sites within Arizona through imported sportfish and live bait species. The implementation of HACCP plans under the new AGFD policy on Aquatic Invasive Species (I.1.7) and other protocols to reduce the opportunity for introductions has

considerable effectiveness; however, those protocols are not absolute protection against an introduction. Because the baitfish industry is an economically and socially important industry in the U.S. (Litvak and Mandrak 1993), the most effective ways to prevent the release and transport of legal and illegal baitfish are through proper regulations and education of both anglers and dealers.

#### Route 4: Inter-drainage transfers

The deliberate movement of fish, equipment, or water between drainages is a route to inadvertently transfer unwanted aquatic organisms from one site to another. As part of sportfish management, AGFD conducts surveys and monitoring at stocking sites to assess the health and quality of the sportfish resource. Equipment used during these activities (boats, nets, waders, holding tubs and other equipment) can become contaminated by disease organisms or veligers of snails or mussels. HACCP protocols are in place that requires disinfection of equipment prior to its use at another site. These protocols are part of standard operating procedures for AGFD field personnel and serve to reduce the risk of inadvertent transfers.

Historically, AGFD would move sportfish from one site to another for management purposes. An example is if a small stock tank experienced a fish kill, individuals of desired species might be moved from another tank instead of fish being purchased to re-start the fishery. This action can contribute to the spread of unwanted aquatic organisms between drainages. Consistent with current practices and as part of the proposed action, AGFD will no longer move sportfish between drainages for management purposes. However, after review of potential risks, AGFD may consider moving sportfish between sites in a connected drainage if it would not contribute to the expansion of unwanted aquatic organisms within the drainage. An example of this could be movement of sportfish species from Roosevelt Lake to Apache Lake on the Salt River. Roosevelt Lake is immediately above Apache Lake and it is the primary source of water for the latter. Any contaminating unwanted aquatic organisms in Roosevelt Lake are likely already present in Apache Lake.

#### Summary

Based on this information, we believe the risks of inadvertent transfer of unwanted aquatic organisms via this route have been minimized by the implementation of HACCP protocols and restrictions on inter-drainage sportfish stocking.

#### Route 5: Inadvertent transport

Anglers can act as accidental or inadvertent vectors to transport unwanted aquatic organisms. Anglers may disperse invasive species via gear other than boats, for instance, on rafts, float tubes, or waders. It is widely thought that some diseases of fish and amphibians may be transmitted on waders or wading shoes. Diseases implicated by this mechanism include whirling disease and amphibian chytridiomycosis, which are present and causing harm to trout and amphibian populations in Arizona. The introduction of any of these diseases is potentially a highly significant event that can result in substantial declines or even extirpation of local populations of special-status species. Other aquatic invasive species (AIS) that are introduced on

fishing gear include aquatic weeds such as Eurasian water milfoil and invasive animals such as the zebra mussel, quagga mussel, and New Zealand mud snail.

Arizona's Invasive Species Management Plan 2008 (Arizona Invasive Species Advisory Council June 30, 2008) identifies water-based recreation, including fishing, as a potential vector for introduction of AIS, noting that introductions can occur when bait buckets and live tank contents are dumped. Equipment and supplies used for fishing (boats, nets, floats, anchors, wading boots, tackle, etc.) can spread AIS. Examples of AIS introductions within the sportfish stocking program area include the distribution of aquatic weeds such as giant salvinia on boats, boat trailers, and other gear; and the distribution of invasive crayfish used as bait. Recreational boaters have a very high probability of dispersing organisms that can be dispersed in bilge water, live wells, or attachment to vessels, trailers, or anchors; and that strict enforcement of precautionary measures is unlikely to be fully effective due to the intensity of boating activity in popular waters.

Currently, the Arizona Governor's Office and the Arizona Game and Fish Department has an active program to educate boaters, anglers, and other recreationists concerning the risks of AIS and the methods available to address those risks. These offices' web sites prominently feature information on mussel control and invasive species in general. Additionally, the Arizona Game and Fish Department Fishing Regulations booklet (AGFD 2011) includes detailed information on AIS and laws.

Although recreational boating is very likely to result in the distribution of invasive species, potentially resulting in a significant adverse impact on native aquatic ecosystems and sensitive species therein, it is likely that in many waters such introductions would occur regardless of angler activities because anglers constitute only a fraction of the recreational water users. In some waters, though, anglers may be the predominant recreational users and one of the principal vectors for human introduction of invasive species. These include waters such as cold mountain lakes and streams that are inaccessible to boaters but may be visited by anglers equipped with gear such as waders and float tubes; as well as waters used by drift boaters, where anglers may comprise the majority of the boating traffic. In such settings, anglers may cause effects on local ecosystems and special-status species by introduction of aquatic invasive species and/or pathogens with or without sportfish stocking.

## Conservation

As a conservation measure, AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

Arizona is involved with several Invasive Aquatic Species programs directed to reduce transport of unwanted aquatic organisms including quagga mussel between waters in the state. New state statutes significantly strengthen legal enforcement of AIS precautions. These efforts are continuing.



## Summary

As shown with the introduction of quagga mussels to the Colorado River, boat-related transport of unwanted aquatic species is documented. Some of this transport is an effect of anglers pursuing sportfish, and a portion is not since not all boaters or other aquatic recreationists are anglers, particularly as those boats kept in the water (such as houseboats) are more likely to be contaminated. The presence of an unwanted aquatic organism in a stocking site may be a result of the proposed action, it may be part of the baseline of those introductions in the past, or the result of activities unrelated to stocking sportfish (illegal stocking, recreational boating, industrial water or other equipment transfer etc.). However, this route will continue to be an issue into the future

### Route 6: Deliberate movement of sportfish and/or live bait associated with fishing for stocked sportfish

Deliberate capture, transport, and release of stocked sportfish and live bait species into other waters by anglers is a significant route for the expansion of nonnative fish, tiger salamanders, and crayfish across Arizona. “Bait bucket” release is a general purpose category which includes a number of purposeful and accidental releases of aquatic species (sportfish, baitfish, tiger salamanders, and crayfish) all of which are unauthorized and many of which are illegal. Many times anglers take such actions out of dissatisfaction with existing conditions at their favorite locations or they want to attempt to create an opportunity in a new location. In Arizona, there are a number of illegal introductions that can be attributed to anglers. For example, black bullhead was illegally stocked into Walnut Creek and Rainbow Lake; northern pike were illegally introduced into Rainbow Lake and Parker Canyon; and green sunfish into Kearny Lake. Table 36 contains additional illegal introductions. For bait species, release of live bait by anglers, either during fishing or disposing of unused bait is the most common route (Courtenay 1995). Litvak and Mandrak (1993) found that 41% of anglers will release live bait after fishing. Picco and Collins (2008) also reported that many anglers surveyed (67%, n = 27) released tiger salamanders bought as bait into the waters where they fished.

Table 36: Stocking sites with likely illegal introductions of nonnative fish species as included in BA chapters. See Appendix F for species names.

| <b>Stocking site</b> | <b>Stocked sportfish<sup>10</sup></b> | <b>Other sportfish</b> | <b>Legal baitfish</b> |
|----------------------|---------------------------------------|------------------------|-----------------------|
| Black Canyon Lake    | MISA                                  |                        | LECY                  |
| C C Craigin Res.     | MISA, PEFL                            | AMNA                   | LECY                  |
| Coconino Lake        |                                       | ESLU                   |                       |
| Fools Hollow Lake    |                                       | ESLU                   |                       |
| Francis Short Pond   | PONI                                  | ESLU                   |                       |

<sup>10</sup> All sportfish species listed are stocked somewhere in the state, but were never officially stocked into these waters. The source of fish for these illegal stockings is unknown.

|                     |                        |                        |             |
|---------------------|------------------------|------------------------|-------------|
| Goldwater Lake      |                        | MIDO                   |             |
| Lynx Lake           | MISA, LEMA, ICPU,      | AMNA                   | CYCA, NOCR, |
| Long Tom Tank       | MISA, LEMA             |                        |             |
| Nelson Reservoir    | MISA, PONI             |                        | LECY        |
| Parker Canyon Lake  | MISA, LEMA, LEMI       | ESLU, AMME             | LECY, GAAF  |
| Peña Blanca Lake    | ONMY, MISA, ICPU, PONI | LEMA, LEMI, AMME, LECY |             |
| Rainbow Lake        | SAVI                   | ESLU, AMME             | NOCR        |
| River Reservoir     | PEFL                   | MIDO                   |             |
| Rose Canyon Lake    |                        |                        | GAAF        |
| Show Low Lake       | PONI                   | MIDO                   |             |
| Upper Lake Mary     | PONI                   |                        |             |
| White Horse Lake    | PONI                   |                        |             |
| Willow Springs Lake | MISA                   | MIDO                   | LECY        |
| Woodland Lake       |                        | AMME                   | LECY        |

### Sportfish

The complexity of human behavior is a challenging aspect to understanding the motivation of anglers to introduce a fish species illegally. That anglers do introduce aquatic species illegally to new areas is well documented across many countries including significant portions of the western United States. The website “Stop Illegal Stocking of Aquatic Organisms” (<http://stopstocking.cowafs.org>) contains discussions of the issue and the problems created by illegal stocking.

The rationale for this illegal act is not fully known, however it is thought by many management professionals that managed fisheries, as opposed to unmanaged, can work to reduce the amount of this illegal activity. The desire for a certain fishery in a convenient location is certainly a strong motivator, particularly when a desirable sportfish such as northern pike is currently not stocked in Arizona. When a new fish species not previously documented from a site is detected, it is not possible to identify the specific location where that fish came from, or that it was deliberately stocked by anglers. In some cases, the logical source is an illegal stocking, particularly when the new site is not hydrologically connected to waters containing the new species, the size of the stocked fish preclude other forms of transport as eggs or fry, and the logistics to allow the transport (road accessibility) are available. Assumptions can be made that illegal transportation of fish occurs within some reasonable traveling distance from source locations, taking into account access, desirability of a fish species, and survivability of the target species in transport. The rarity of a species in the area for potential transport is also a factor in determining if a stocked population of a particular species would be used as a source for illegal stocking. Persons intent upon illegally transporting and stocking sportfish species must have a source, and many options are available including purchase and shipment to Arizona from dealers and collection from a local source.

For example, the source of yellow perch (PEFL) in CC Cragin and River Reservoir is not known. AGFD stocking records indicate the species was stocked into Lyman Lake (1979), Marshall Lake (1941-1966), Morton Tank (1989), and Mormon Lake (1965-1993), but fishable populations are only reported from Upper Lake Mary. The source population for Upper Lake Mary was likely Mormon Lake, since that lake is above it in the drainage. The source of yellow perch in River Reservoir is not known; the species was documented in 2000 (see BA section on River Reservoir) and is likely reproducing. Yellow perch are not found elsewhere in the West Fork Little Colorado subdrainage, and are no longer found in Lyman Lake where they were historically stocked (one stocking in 1979 and the lake was later renovated) so the likely source is outside of the area, which suggests illegal introduction.

For widespread species such as largemouth bass, there are many existing populations that could act as a source population, many of which are not currently stocked with that species. The connection of the largemouth bass populations maintained by stocking under the proposed action to potential source populations is less clear as a result. With the exception of white crappie and yellow perch, the remaining sportfish species are widely distributed and all stocking would occur into areas already occupied by the species.

The proposed action includes stocking of yellow perch into three new locations in the Jack's Canyon complex of the Little Colorado River watershed; Long Lake (Diablo), Soldiers Lake, and Soldier's Annex. This complex is adjacent to the Walnut Creek Complex containing Upper Lake Mary where there is a history of stocking this species, but the new sites are not hydrologically connected to Walnut Creek. If yellow perch establish in these new sites, they will provide additional sources of the species for illegal transport from this drainage.

White crappie is not widely distributed in Arizona (Minckley and Marsh 2009) and is only abundant in Lake Pleasant on the lower end of the Agua Fria River. It is proposed for stocking in Fain and Lynx lakes, in the upper Agua Fria drainage, and is not currently known from those sites. If white crappie establish in Fain or Lynx Lake, they will provide additional sources of this species for illegal transport.

Movement of sportfish species is illegal in Arizona, as is all movement of aquatic species. However, documentation of novel sportfish appearances continues; unwanted sportfish at CC Cragin was documented in 2007 with yellow perch found in 2008. Despite efforts to prevent this type of action, it is likely to continue to occur over the 10-year period covered by the consultation regardless of whether the proposed action of stocking sportfish is implemented. The active management of public waters through management of compatible sportfish species can reduce occurrences of illegal introductions.

## Baitfish

At present in Arizona, four species of live baitfish (fathead minnows, threadfin shad, red shiner, and mosquitofish) are prohibited in Coconino, Navajo, Apache, Pima, and Cochise counties; they are permitted on all waters of the counties of La Paz, Maricopa, Mohave, Pinal, and Yuma counties. No waters of any other counties are open except: 1) the mainstem portions of the Gila and Salt rivers, and the portion of the Verde River downstream of the Tuzigoot Bridge including

impounded reservoirs, 2) Tonto Creek from Gisela downstream, 3) the portions of Apache, Horseshoe, Pleasant, and Roosevelt lakes lying outside of prohibited counties, and 4) the portion of the San Francisco River in Greenlee County. These species may be acquired from dealers, or captured in the wild for use at the site.

Golden shiner and goldfish may be used as live baitfish in fewer areas in the state and they must be purchased from a live bait dealer or captured wild and used at the capture locations. They are permitted on all waters of the counties of La Paz and Yuma, and within no other counties with the following exceptions: 1) Lake Mead, 2) Alamo Lake, and 3) the Colorado River downstream from Hoover Dam to the international boundary with Mexico, including impounded reservoirs. Sunfishes, tilapia, and carp are also permitted for use as baitfish but must be collected at the location of use; they are not approved for sale as bait in Arizona. Per R12-4-316, anglers in Arizona may possess live baitfish for use as live bait, and live baitfish legally captured in one location are to be used only at that location and not transferred to another water body (R12-4-317). Per the original regulations adopted in 1947, it is illegal to release live baitfish and they must be disposed of by burial on land far from water. At present, waters where baitfish are legally permitted have historically been permitted at those locations, or are in locations where there is no conflict or perceived resource issue.

Many of the approved live baitfish species have also been historically stocked by the Department into lakes to provide a forage base for top predator fishes, and mosquitofish have been stocked extensively across the state into ponds for insect control. Because all of the baitfish species discussed above have been legally introduced into the state, it is impossible to determine if they became established in certain waters because of these legal introductions or through the illegal disposal of live baitfish. Litvak and Mandrak (1993) reported that although regulations have prohibited the release of live baitfish for decades, the release or improper disposal of baitfish has enabled many species to establish throughout the state as well as throughout North America. However, once again, because these species may have been legally stocked at one time it is virtually impossible to determine what mechanism of introduction was responsible for their establishment.

“Bait-bucket” introductions into stocking sites of legally acquired baitfish are not the only concern. Anglers or commercial dealers may also move bait species to isolated tanks or other waters for the purpose of creating a population of the species for later exploitation (Welcomme 1988, McMahon and Bennett 1996). The appearance of green sunfish, fathead minnows, and other species across the landscape into areas that have never been legally stocked with these species is a likely example of this illegal activity. Arizona regulations prohibit the release of any live baitfish into any waters in Arizona; however, some anglers do release them alive to the water. Effects that have a moderate probability of occurring in any given year are almost certain to occur during a project with a long time frame. For example, Ludwig and Leitch (1996) calculated the probability of bait-bucket transfers of fish occurring from the Hudson Bay basin to the Mississippi River basin. The likelihood of a single angler on a single day releasing baitfish was only 0.0117 (1.2%). However, over a year with 19 million angler days (see Ludwig and Leitch 1996 for explanation of how angler days were calculated for this analysis) the probability of not just one, but up to 10,000, successful releases of baitfishes rises to 0.996 (99.6%), for those areas where baitfish use is legal. Releases in areas where baitfish use is illegal are likely

less than this. We anticipate that “bait bucket” introductions into stocking sites and/or other waters across the action area will occur over the time period covered by this consultation.

The stocking of yellow perch and white crappie and creation of new populations could result in increased use of live baitfish at these sites. However, use of baitfish is illegal in all of these waters. Discussion and analysis of illegal bait fish use and stocking associated with existing sites is found in cumulative effects analysis.

### Tiger salamanders

It is legal for individuals in possession of a valid fishing license in Arizona to import, take from the wild, and transport tiger salamanders for personal use as bait except within a portion of Cochise and Santa Cruz counties. The restricted area contains Parker Canyon Lake and the San Rafael Valley (the range of the Sonoran tiger salamander); and violation of the regulations is uncommon; in 21 years of law enforcement patrol at the lake, an angler using tiger salamanders as bait was never encountered (J. Mullican, AGFD, pers. comm. 2010). However, anglers, bait sellers, or other entities have brought tiger salamanders to the lake and have also released them into stock tanks in the region. It is illegal to release live tiger salamanders to any water in Arizona, but as noted above, this violation occurs.

Tiger salamanders are generally used as bait for the larger predatory sportfish such as largemouth bass. They are legal to use anywhere in the state except in the area around Parker Canyon Lake. As with all aquatic wildlife, it is not legal to introduce individuals to waters in Arizona, however this does occur, particularly by those creating a future source of tiger salamanders to use as bait. This practice has likely diminished since regulations made it illegal to collect and sell tiger salamanders from the wild, reducing the incentive for dealers to establish populations.

### Crayfish

Crayfish are legal to use as bait for stocked sportfish if collected onsite and are generally collected from the wild for use. There are restrictions within the action area that prohibit the transport of any live crayfish within the action area (except for a limited area along the lower Colorado River). Collected crayfish may be used at the point of collection. Most if not all of the stocking sites are already contaminated by crayfish, and the extent of additional contamination likely to occur as a result of angler transport of crayfish is uncertain. AGFD already provides information on restrictions on crayfish use and transport, and a program to encourage legal harvest for consumption.

### Conservation

A common criticism of existing regulations is that anglers are unaware of proper collection and disposal of bait species. It is also now quite simple to transport bait species for long distances using equipment readily available in retail sportsman supply stores, making the enforcement of current regulations even more challenging. Because the baitfish industry is an economically and socially important industry in the U.S. (Litvak and Mandrak 1993), the most effective ways to prevent the release and transport of legal and illegal baitfish is through proper regulations and

education of both anglers and dealers.

As a conservation measure, AGFD is reviewing its bait regulations and proposes to increase the educational information available for anglers regarding proper use and disposal methods for all live bait species. This includes particular efforts for tiger salamanders in the restricted use area especially at Parker Canyon Lake.

In the Arizona Statewide Wildlife Conservation Strategy 2005-2010 (AGFD 2006), both bullfrogs and crayfish were identified as significant stressors to native species. Recommendations to limit the recreational and commercial use of these species as bait were part of suggested future management.

### Summary

Collection from the wild of live bait species (including crayfish, fishes, bullfrogs, and tiger salamanders) in Arizona contributes to the risk of introduction of unwanted aquatic organisms to new locations in the action area if regulations regarding their capture and disposal are not followed. Introductions of baitfish species that are potential predators or competitors with native aquatic species into occupied habitats, or into the connected drainage above occupied habitats remains a threat to native-species conservation. While there are regulations and rules in place that make such actions illegal, such introductions are likely to continue regardless of whether the proposed stocking program is implemented, particularly since most of the proposed stocking actions are for rainbow trout and live bait is generally not used for this species. Enforcement of the regulations is difficult in the field, and there is likely a subset of the angling public that is unconcerned with the resource consequences of their acts.

Route 7: Deliberate, illegal movement stocked sportfish or their progeny or other unwanted aquatic organisms present as a result of the proposed action from stocking sites to other waters of Arizona by members of the public who are not anglers.

In comparison with the other routes discussed, this is a smaller component of illegal movement of aquatic species associated with sportfish stocking. Non-anglers may move aquatic species for several reasons; to create populations of fish to address aquatic insect problems such as mosquitoes in ponds or other waters near their homes; to enjoy watching aquatic species; or to “rescue” such species from waters that are drying up or otherwise becoming unsuitable or to expand conservation populations (the illegal stocking of Sonora chub into a tank near Peña Blanca Lake in 2010 may be an example of this). Non-anglers are less likely than anglers to understand the rules and regulations concerning movement of aquatic species, since they have little incentive to read the regulations.

### Conservation

Existing programs within AGFD attempt to educate the non-angling public about restrictions on movement of aquatic species.

### Summary

The magnitude of effects resulting from this route are less than for the others in that most such movement of species by non-anglers is not of sportfish or bait species and there is likely less incentive to move aquatic species between stocking waters or other waters in the state where native species occur.

## **Effects related to anglers pursuing stocked sportfish**

### Angler access effects

In response to angler demand, AGFD stocks a variety of waters throughout the state with sportfish and every year over 400,000 anglers take advantage of fishing opportunities in Arizona. In addition to angling, most stocked waters and surrounding areas are also used for a variety of other recreational activities such as camping, boating, canoeing, kayaking, swimming, wading, hiking off-road vehicle (ORV) use, and wildlife observation and photography. Many of the impacts to wildlife and habitat caused by anglers are also caused by other recreational users, confounding a precise assessment of the contribution of angler impacts. However, angling has an incremental contribution to the totality of recreational impacts to wildlife and habitat, which can vary due to site-specific conditions.

A number of studies have examined the potential for effects to fish and wildlife species and their habitats from recreational activities. Summaries of these potential impacts are provided in Anderson (1995), Boyle and Samson (1985), Knight and Cole (1995), and Trulio (2005). Maitland and Turner (1987) summarized the effects of anglers on fish and wildlife resources and habitat. These documents are incorporated by reference.

Recreational angling may have a variety of impacts including: 1) disturbance of riparian or benthic systems by walking through the area; 2) degradation of water quality from stream bank destabilization, wading, human waste, and trash, 3) disturbance from motor boats; 4) introduction of angler debris; 5) inadvertent spread of pathogens, diseases, and invasive species by anglers, and 6) direct mortality to non-target aquatic species.

The potential for angling to produce negative impacts depends on the frequency, intensity, location, and type of use. For terrestrial wildlife, infrequent and unpredictable recreation without pattern can be more damaging than frequent predictable use. Activities with patterns may cause species to avoid areas of frequent use and they may still be successful. Habituation by species can also occur in areas of high, frequent use. Activities without patterns can create more of an impact per event. Any activities conducted off established recreational areas, such as trails or boat docks, and in the habitat itself are more likely to startle nesting birds or other wildlife and damage habitat. (Marcum 2005, USFWS 2002b, Weston et al. 2011).

Consequently, if fishing opportunities begin during nesting season, there is a concern for nest abandonment or decreased viability of the young who might receive less food and protection from stressed parent-birds. If fishing opportunities begin before nesting season, either the birds would tolerate the disturbance and nest, successfully or unsuccessfully, or move to an undisturbed location where they would nest, successfully or unsuccessfully.

Riparian areas are subject to impacts from recreationists (Fresque and Plummer 2004) receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Not surprisingly, riparian areas near cities receive greater use than those farther away from development. The demand for recreation in riparian areas will continue to increase in proportion to increasing human populations. Impacts can be more devastating in the Southwest, where riparian habitat tends to be more linear, narrow, and dissimilar to adjacent habitat than in other parts of the country.

Shoreline vegetation along stocked lakes and streams may be trampled by anglers or their vehicles (primarily automobiles, ORV's, or beached watercraft). The potential severity of such effects depends on the type of vegetation, the type of shoreline, and the intensity of angler use.

The type of shoreline also determines angler effects. Habitat that has already been lost to developed areas such as bridges and docks would incur no further damage. However, riparian areas are particularly vulnerable to vegetation disturbance and soil compaction that affects plant regeneration (Cole and Spildie 2010). The loss of plant cover due to trampling may cause indirect effects such as erosion and sedimentation associated with loss of roots and the plants' ability to hold soils. In addition, removal of vegetation results in increases to edge in riparian areas which affects breeding attempts and success by riparian birds (Robertson and Flood 1980). These changes may alter plant communities and alter food and nutrient inputs to surrounding lakes and creeks with listed and candidate species. Terrestrial insects and other organisms that get into the lake and become prey to aquatic organisms may also be affected indirectly through loss of shoreline vegetation that serves as habitat (CDFG 2010).

However, in riparian areas it is anticipated that anglers will likely be on foot and either alone or in small parties. It is also anticipated that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream and transport of cumbersome equipment (fishing pole, waders, tackle box, etc.) anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, it is expected that anglers, once they reach their destination, are unlikely to fish in tight areas where vegetation is dense that causes casting to be difficult.

Anglers in trout streams commonly wade in the stream. There is a risk that this activity could trample egg masses of fish or frogs or injure individuals hiding in the benthic cover (rocks or vegetation). Roberts and White (1992) report a Montana study of experimental trampling of eggs in the manner of an angler wading through trout redds. In a laboratory setting, they found that a single wading killed up to 43% of trout eggs and pre-emergent fry. Species that are resident in the stocking area and have eggs that attach to rocks in riffles and runs are likely to be affected, as are those that have egg masses in shoreline vegetation that can be trampled while the stream is being accessed.

Riparian bird, amphibian, and reptile species and aquatic species could be disturbed (by noise or visual sighting) by anglers moving through aquatic areas where sportfish stocking occurs within the range of these listed and candidate species. Such disturbance could take many forms, e.g. flushing animals from feeding and holding areas, animals relocating within the water column,



animals seeking cover, or animals injured by powerboat activity.

Tuite et al.(1983) concluded that fishing not done from a motorboat is less disturbing to terrestrial wildlife than either hunting or motorized boating because anglers are usually quiet and relatively stationary. Knight et al. (1991) found that anglers had no apparent effect on presence or absence of bald eagles, ravens and common crows along a river in Washington; however, fewer bald eagles and ravens used the river when anglers were present and angler presence also caused decreased foraging in these two species.

### Conservation

AGFD is including in the conservation plan efforts to coordinate with land management agencies to identify potential effects to habitat of southwestern willow flycatcher, and yellow-billed cuckoo from angler access. These measures focus on coordination with landowners (particularly the U.S. Forest Service) on concerns at recreational sites. For the New Mexico meadow jumping mouse, AGFD will both coordinate with the U.S. Forest Service on effects at stocking sites in relationship to recreational uses including angling, and will provide protection for mouse habitat on its lands along the West Fork Black River.

### Summary

This type of physical habitat disturbance, potential behavioral disturbance, and inadvertent mortality of early life stages of conservation species has not been identified (except for the mouse), as significant adverse effects. Stocking at most of the proposed locations is part of an ongoing activity and new disturbance is expected to be low and often makes up some incremental part of the overall recreation at any given site; however continued presence of anglers leads to maintenance of trails and does not allow for regeneration of habitat. The proposed conservation measures provide opportunities to define and address any areas of concern.

The loss of fish eggs or larvae to trampling by anglers in the stream is an effect; however, the magnitude varies considerably between native fish species due to number of occupied sites that are stocking sites, seasonality of stocking, and the natural history of the native fish species for selecting spawning and nursery habitats and less likely in small streams where wading is less necessary in order to access fishing opportunities.

### Fishing tackle

Monofilament fishing line and fishing tackle also present a risk to native species, particularly fish-eating birds. Anglers may discard used or old fishing line onto the ground, and old line that breaks while a fish is hooked remains with the fish in the water. In the latter case, a bird may become entangled while preying on the moribund fish. If lead weights are used, those lost with the monofilament line may be ingested by waterfowl, and contribute to lead poisoning in predatory birds such as bald eagles. Small passerine birds such as flycatchers may attempt to use discarded monofilament line for nesting, and may also become entangled.

## Conservation

Monofilament Recovery Programs involve placement of informational signage and disposal bins at stocking sites to reduce discarded line on the ground or in the water. Information on the benefits of replacing old line that is more likely to break under pressure with new line is also included, which assists in reducing the potential for line breakage while a fish is hooked.

## Summary

Monofilament line poses a minor risk to consultation species.

## Non-target take

Non-targeted fish species may incidentally be caught while angling for stocked fish. Twenty-six fish species in Arizona are fully protected and may not be taken or possessed at any time (AGFD 2011). Roundtail chub is a legal sportfish in Arizona, as are Gila and Apache trout and headwater chub in Fossil Creek. Of the native fish species of consideration in this consultation, headwater chub is at risk of incidental catch by anglers fishing for stocked trout in areas outside of Fossil Creek and bonytail may be at risk from stocking at La Paz County Park Lagoon. Incidentally hooked fish that are fully protected or are excess to bag limits or do not meet the target size must be immediately released unharmed to the waters where they are hooked. Mortality of hooked fish that are released is related to the types of hooks used (barbed or barbless), where the fish was hooked, and the amount of care taken to release the fish and return it to the water. There is also a component of mortality of hooked fish where they are not returned to the water, but are discarded as “trash fish.” This situation was reported from New Mexico for headwater chub (USFWS 2010b).

## Conservation

AGFD proposes to provide additional angler education at headwater chub and bonytail stocking sites in the form of signs or other media to reduce mortality of these species from inadvertent capture. Such signs are already in place along portions of the Colorado River for bonytail, and inclusion of such signage at La Paz County Park Lagoon is included in the proposed action.

## Summary

Effects to bonytail from angler by-catch are minor, and the proposed conservation measure adequately reduces the risk of improper disposal of any captured bonytail.

For headwater chub, implementation of the conservation measure will hopefully reduce the amount of improper disposal of captured chub; however, the overlap between occupied headwater chub habitat and stocking sites will continue to result in inadvertent bycatch with some degree of hooking or handling mortality of headwater chub.

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Federally funded sportfish stocking on Tribal lands is not considered under cumulative effects as it is subject to section 7 consultation.

The site specific analyses contain information on cumulative effects within those action areas. We anticipate similar effects of land and water management activities, urbanization, and other human activities on the landscape to continue across this wider action area.

The potential effects of climate change on aquatic habitats in Arizona are discussed in detail in recent species evaluations and biological opinions (for example, USFWS 2008a, 2009a, and 2010a, f). All the aquatic consultation species will be affected by any changes in precipitation amounts, patterns, or other results of those changes on the landscape (for example, increased wildfire risk). While the native aquatic species evolved in the southwest, and survived many droughts in their evolutionary histories, the physical baseline condition of their habitat is in many places so altered that their ability to withstand drought conditions has been compromised. Further complicating the problem is the widespread presence of nonnative aquatic species in the remaining aquatic habitats that in some cases precludes the presence of the native species in the likely best remaining habitat areas, or, in habitats more likely to be marginal, results in increased risk of predation and competition as the size of the habitat decreases.

#### *Climate change*

Several recent studies predict continued drought in the southwestern United States due to global climate change, including the lower Colorado River basin. Seager et al. (2007) analyzed 19 different computer models of differing variables to estimate the future climatology of the southwestern United States and northern Mexico in response to predictions of changing climatic patterns. All but one of the 19 models predicted a drying trend within the Southwest. A total of 49 projections were created using the 19 models and all but three predicted a shift to increasing aridity in the Southwest as early as 2021–2040 (Seager et al. 2007). Recently published projections of potential reductions in natural flow in the Colorado River Basin by the mid-21st century range from approximately 45 percent by Hoerling and Eischeid (2006) to approximately six percent by Christensen and Lettenmaier (2006). The U.S. Climate Change Science Program recently completed a report entitled “Abrupt Climate Change, A report by the U.S. Climate Change Science Program and the Subcommittee on Global Climate Change Research” (U.S. Climate Change Science Program 2008a) that concluded, if model results are correct, the southwestern United States may be beginning an abrupt period of increased drought (U.S. Climate Change Science Program 2008b).

The information on how climate change might impact Arizona is less certain than current drought predictions. However, virtually all climate change scenarios predict that the American southwest will get warmer during the 21st century (IPCC 2001, 2007). Precipitation predictions show a greater range of possibilities, depending on the model and emissions scenario, though precipitation is likely to be less (USGCRP 2001, Seager et al. 2007). To maintain the present

water balance with warmer temperatures and all other biotic and abiotic factors constant, precipitation will need to increase to keep pace with the increased evaporation and transpiration caused by warmer temperatures.

Key projections to keep in mind include:

- decreased snowpack — an increasing fraction of winter precipitation could fall as rain instead of snow, periods of snowpack accumulation could be shorter, and snowpacks could be smaller; ironically, due to changes in snow-precipitation characteristics, runoff may decrease even if total precipitation increases (Garfin 2005, Seager et al. 2007);
- earlier snowmelt — increased minimum winter and spring temperatures could melt snowpacks sooner, causing peak water flows to occur much sooner than the historical spring and summer peak flows (Stewart et al. 2004); and
- enhanced hydrologic cycle—in a warmer world an enhanced hydrologic cycle is expected; flood extremes could be more common causing more large floods; droughts may be more intense, frequent, and longer-lasting (Seager et al. 2007).

Changes to climatic patterns may warm water temperatures, alter stream flow events, and may increase demand for water storage and conveyance systems (Rahel and Olden 2008). Warmer water temperatures across temperate regions are predicted to expand the distribution of existing aquatic nonnative species by providing 31 percent more suitable habitat for aquatic nonnative species, which are often tropical in origin and adaptable to warmer water temperatures. This conclusion is based upon studies that compared the thermal tolerances of 57 fish species with predictions made from climate change temperature models (Mohseni et al. 2003). Eaton and Scheller (1996) reported that while several cold-water fish species in North America are expected to have reductions in their distribution from effects of climate change, several warmwater fish species are expected to increase their distribution. In the southwestern United States, this situation may occur where the quantity of water is sufficient to sustain effects of potential prolonged drought conditions but where water temperature may warm to a level found suitable to harmful nonnative species that were previously physiologically precluded from occupation of these areas. Species that are particularly harmful to native aquatic species such as the green sunfish, channel catfish, largemouth bass, and bluegill are expected to increase their distribution by 7.4 percent, 25.2 percent, 30.4 percent, and 33.3 percent, respectively (Eaton and Scheller 1996). Rahel and Olden (2008) expect that increases in water temperatures in drier climates such as the southwestern United States will result in periods of prolonged low flows and stream drying. These effects from changing climatic conditions may have profound effects on the amount, permanency, and quality of habitat for native aquatic species. Warmwater nonnative species such as red shiner, common carp, mosquitofish, and largemouth bass are expected to benefit from prolonged periods of low flow (Rahel and Olden 2008).

Climate change could also provide conditions that benefit nonnative species, increasing their proliferation, and increase the threat from nonnative fish predation and competition to native aquatic species. Rahel et al. (2008) examined climate change models, nonnative species biology, and ecological observations, and concluded that climate change could foster the expansion of nonnative aquatic species into new areas, magnify the effects of existing aquatic nonnative

species where they currently occur, increase nonnative predation rates, and heighten the virulence of disease outbreaks in North America. Many of the nonnative species have similar, basic ecological requirements as our native species, such as the need of permanent water. Rahel et al. (2008), and Carveth et al. (2006) found that climate change will likely favor nonnative fish species such as largemouth bass, yellow bullhead, and green sunfish, over native aquatic species, in part because they have higher temperature tolerances. Drying of stream channels will intuitively create less habitat and greater competition for limited space and habitat and may reduce opportunities for nonnative dispersal using hydrological connectivity.

Rahel et al. (2008) also noted that climate change could facilitate expansion of nonnative parasites. This could be an important threat to native aquatic species. Optimal Asian tapeworm development occurs at 25-30 °C (77-86 °F) (Granath and Esch 1983), and optimal anchorworm temperatures are 23-30 °C (73-86 °F) (Bulow et al. 1979). Cold water temperatures in parts of the range of some native aquatic species may have prevented these parasites from completing their life cycles and limited their distribution. Warmer climate trends could result in warmer overall water temperatures, increasing the prevalence of these parasites.

The effects of continuing and increasing surface and groundwater uses exacerbate the current, long-term drought facing the arid southwestern United States. Philips and Thomas (2005) provided streamflow records that indicate that the drought Arizona experienced between 1999 and 2004 was the worst drought since the early 1940s and possibly earlier. The Arizona Drought Preparedness Plan Monitoring Technical Committee (ADPPMTC) (2008) assessed Arizona's drought status through June 2008. They found that the Verde and San Pedro watersheds continue to experience moderate drought (ADPPMTC 2008), and the Salt, Upper Gila, Lower Gila, and Lower Colorado watersheds were abnormally dry (ADPPMTC 2008). Ongoing drought conditions have depleted recharge of aquifers and decreased baseflows in the region. While drought periods have been relatively numerous in the arid Southwest from the mid-1800s to the present, the effects of human-caused impacts on riparian and aquatic communities may compromise the ability of these communities to function under the additional stress of prolonged drought conditions.

Drought and climate change will also impact watersheds and subsequently the water bodies in those watersheds. Drought and especially long-term climate change will affect how ecosystems and watersheds function. These changes will cause a cascade of ecosystem changes, which may be hard to predict and are likely to occur non-linearly (Seager et al. 2007).

As an example, drought and climate change will cause changes in fire regimes in all southeastern Arizona vegetation communities. The timing, frequency, extent, and destructiveness of wildfires are likely to increase and may facilitate the invasion and increase of nonindigenous plants. These changed fire regimes will change vegetation communities, the hydrological cycle, and nutrient cycling in affected watersheds (Brown et al. 2004). Some regional analyses conservatively predict that acreage burned annually will double with climate change (MacKenzie et al. 2004). Such watershed impacts could cause enhanced scouring and sediment deposition, more extreme flooding (quicker and higher peak flows), and changes to water quality due to increases in ash and sediment within stream channels. Severe watershed impacts such as these, when added to reductions in extant aquatic habitats, will severely restrict sites available for the conservation of native fish and other aquatic vertebrates and make management of extant sites more difficult.

In summary, over the 10-year period covered by this consultation, the native aquatic species are likely to be subject to continuing drought conditions brought on by changes to climate patterns. The extent of the drought conditions is unknown; however, based on the recent past and the information from the models, it is reasonable to assume that drought will continue to be a factor for aquatic habitats over the next 10-years. The magnitude of that effect, combined with continuing human use of surface and groundwater resources, is of significant concern for some aquatic habitats. While additional degradation of aquatic habitats and the native species they support is likely to occur, we do not believe that these changes will result in the extinction of any consultation species during the period covered by this consultation. Ongoing conservation actions included in the environmental baseline and new efforts contained in the proposed action are working to increase the baseline condition of native species over this period.

#### *AGFD activities not related to the proposed action*

AGFD normally imports warmwater sportfish for stocking, although they do maintain small stocks of bluegill, largemouth bass and channel catfish at Bubbling Ponds State Fish Hatchery. As the operation of this hatchery for sportfish is entirely state funded, any effects are part of the cumulative effects. These fish are used for exhibit purposes at sportfish expos or other public events and are periodically culled and used at approved stocking sites within the state. No additional imports of these species for hatchery cultivation are anticipated.

Of the state hatcheries involved in fish production for stocking purposes, only Bubbling Ponds raises fish in outdoor ponds where nonnative bullfrogs may be in contact with sportfish. *Bd* has also been detected at Bubbling Ponds. Bubbling Ponds rarely stocks warmwater sportfish from the hatchery; however there are recent stockings (bluegill in 2010, largemouth bass in 2009, and channel catfish in 2003). Any future stockings would comply with the appropriate HACCP stocking protocols and coordination with the AGFD Nongame branch herpetologists to minimize the potential for transporting *Bd* if the stocking was to an area where concerns for the spread of *Bd* to native amphibians exist.

#### *Summary*

Based on this information, we believe the risks of *Bd* transmission from the coldwater hatchery stockings are negligible and those from any warmwater stockings are low. Please review the discussion of chytridiomycosis vectors and diseases and parasites included in Appendix D for additional information.

#### *Spread of unwanted aquatic species*

Cumulative effects considered for this consultation focus on those that further contribute to the spread of unwanted aquatic organisms in Arizona similar to Routes 3, 5, 6, and 7. Not all introductions of species to the state, or movement of species within the state is connected to the proposed action and the actions of anglers pursuing the species proposed for stocking. Cumulative effects focus on all other illegal movement of nonnative fish, amphibians, and invertebrates whether these are accidental or deliberate. It also includes movement of plants or

other materials that can facilitate the spread of parasites or disease vectors to previously uninfected waters via boats or other water-sports gear. These activities may, or may not, have their origin at waters stocked with sportfish species under the proposed action. There are many waters in Arizona that are not part of the proposed stocking program that contain sportfish species and are open to fishing with or without the legal use of live baitfish or tiger salamanders. For example, Lake Pleasant on the Agua Fria River, Bartlett Lake on the Verde River, and Roosevelt Lake on the Salt River are not part of the proposed action but they are significant sportfishing destinations and can be sources for illegally transported nonnative species.

There are several routes considered in this analysis. These were chosen based on the fact that some sort of deliberate or inadvertent introduction has been documented due to that route, or the route is identified as one where introductions are likely to occur over time. Thus, there is more than a reasonable certainty that an introduction event would occur within the 10-year period covered by this consultation, however, these activities are not attributable to the current proposed action. The routes considered are:

8. Importation of fish for use in private ponds or sites not stocked by AGFD.
9. Importation and release of ornamental aquatic species or species for food.
10. Accidental aquaculture releases.
11. Transport of aquatic species not part of the stocking program or transport from sites not part of the stocking program by anglers or other members of the public.
12. Transport of bullfrogs to create harvestable populations.

#### Route 8: Importation of fish for use in private ponds or sites not stocked by AGFD

Individuals or businesses may also apply for stocking permits for private waters (ARS R12-4-410; adopted in 1989) issued by the Department for species that may be beneficial for vegetation control (e.g., white amur) or insect control (e.g., mosquitofish). The Department evaluates any risk per stocking permit request including the geographic location and proximity to open water as well as the security of the facility.

Warmwater fish stocking into Tempe Town Lake by the City of Tempe is an example of stocking under a permit. Owners of stock tanks can also apply for permits to stock fish for personal use. Fish acquired for stocking under these permits must be obtained from commercial dealers and are subject to fish-health inspections and other procedures to ensure that unwanted aquatic organisms are not included in the shipments. The risks of this occurring are the same as for AGFD imported fish species as discussed previously.

There are individuals who illegally establish sportfish or other species populations in private ponds without obtaining a permit. Some sportfish dealers will require proof of a stocking permit prior to providing fish for private stocking, and others do not. Private individuals may also collect desired species from the wild at stocking sites or other locations where the species is established. Rainbow trout observed in Gordon Creek (headwater chub habitat in the Tonto Creek drainage) may have been placed there by a landowner, since no other rainbow trout were found, and trout from the stocking reach in Haigler Creek were unable to move upstream due to

fish barriers in Gordon Creek. Individuals may also move green sunfish or bullheads to private ponds for fishing, as these are easy to catch for children.

Individuals may also move small fish species for biological control of mosquitoes or other aquatic insect pests. This movement contributes to the presence of these species across the landscape, although the species usually moved for such purposes (mosquitofish, red shiners, fathead minnow) are generally ubiquitous across the landscape.

#### Conservation measures

There are protocols in place by AGFD to provide permits to private or public parties interested in stocking fish in Arizona.

#### Summary

For those persons who complete the application process, there remains a risk of introduction of unwanted aquatic species as described under the effects of the action. Contaminated loads are not inspected on site prior to stocking, as it is not the responsibility of AGFD to inspect such shipments. Despite existing protocols, there is considerable opportunity for persons not wishing to obtain permits to import or illegally move fish from wild populations. It is expected that this activity will continue into the future.

#### Route 9: Importation and release of ornamental aquatic species or species for food

Pet stores and aquatic hobbyist outlets import fish and other aquatic species for the pet trade. There are inter-state regulations on the import of aquatic species, including fish, frogs, snails, and other species. However, once these species are in private hands, they may be illegally released into the wild. Most of these species; including sailfin molly, Mexican molly, guppy, swordtail, convict cichlid, and goldfish have been occasionally found in the Phoenix metropolitan area, likely due to the number of urban waters located within Phoenix (Marsh and Minckley 1982). Most are not expected to survive due to habitat incompatibility and their captive histories. The recent documentation of peacock bass in canals in the Yuma area is also likely the result of release of illegally imported individuals.

A direct link between the increased likelihood of fish introductions in proximity to highly developed or urban areas has been documented (Whittier and Kincaid 1999). Warmwater fishes are the most common with regard to introduced species, and urban areas are often geographically close to large warmwater lakes and reservoirs. In California, Marchetti et al (2006) found direct correlation between urbanization, the decline in native fish species, and the increase in homogenous species diversity of nonnative fish species. However, the authors postulate that many or most of these introductions (near urban areas) will not spread outside of the introduction watersheds because of loss of connectivity associated with urbanization and the haphazard nature of the actual introductions.



Exotic species such as snakeheads, crabs, and other species in the food trade are also illegally released into the wild to create sources for future harvest. Mitten crabs are also a species whose spread is likely due to releases for the commercial food market.

#### Conservation measures

There are state and Federal laws, regulations, and other protocols to reduce the opportunity for transports of unwanted aquatic organisms across state lines. This system is not absolute, and there are flaws that allow for the illegal transport of such species that will continue to exist into the future.

Neither AGFD nor the Arizona Department of Agriculture regulate the ornamental pond or aquaria industries and there are no stocking permits or aquaculture permits required by law for possession of these fish used in these industries. However, per R12-4-405 the release of these fish is prohibited beyond the aquarium or ornamental pond.

#### Summary

This route is likely to continue to contribute to additional introductions into Arizona or the spread of species currently found in the state over the 10-year period covered by this consultation.

#### Route 10: Accidental aquaculture releases

A person who wishes to raise fish in captivity as a commercial enterprise is required to obtain an aquaculture permit from the Arizona Department of Agriculture. The permit application will require that information regarding the location, water source and water disposal, and the responsible person be provided. The application also must include the species being cultured. Concerns regarding importation, local contamination, and distribution of product are the same as any hatchery operations included in the proposed action. These regulations ultimately have an impact to reduce unintentional releases of cultured fish; however, there is still a risk that may be manageable, but variable.

#### Conservation measures

Commercial aquaculture operations in Arizona must follow state rules and regulations. Onsite releases of unwanted aquatic organisms are limited by site design and operational protocols.

#### Summary

This route is subject to regulations to limit potential escapement of unwanted aquatic species to the wild, however, we anticipate there is some continuing level of risk.

#### Route 11: Transport of aquatic species not part of the stocking program or transport from sites not part of the stocking program by anglers or other members of the public.

There is a level of illegal transport of unwanted aquatic species in Arizona that occurs due to deliberate or inadvertent actions by the public. There are many sites in Arizona where sportfish or other nonnative aquatic species are present that are not proposed for future stocking under the proposed action. Among these actions are those related to individuals who move fish or other organisms to protect them from failing habitats such as lack of water or declines of water quality or other reasons. Persons who move aquatic species do so for a variety of reasons, and the impetus to do so may have little recognition of regulations or rules.

“Bait-bucket” introductions into stocking sites of legally acquired baitfish are not the only concern. Anglers or commercial dealers may also move bait species to isolated tanks or other waters for the purpose of creating a population of the species for later exploitation (Welcomme 1988, McMahon and Bennett 1996). The appearance of green sunfish, fathead minnows, and other species across the landscape into areas that have never been legally stocked with these species is a likely example of this illegal activity. Arizona regulations prohibit the release of any live baitfish into any waters in Arizona; however, some anglers do release them alive to the water. Effects that have a moderate probability of occurring in any given year are almost certain to occur during a project with a long time frame. For example, Ludwig and Leitch (1996) calculated the probability of bait-bucket transfers of fish occurring from the Hudson Bay basin to the Mississippi River basin. The likelihood of a single angler on a single day releasing baitfish was only 0.0117 (1.2%). However, over a year with 19 million angler days (see Ludwig and Leitch 1996 for explanation of how angler days were calculated for this analysis) the probability of not just one, but up to 10,000, successful releases of baitfishes rises to 0.996 (99.6%), for those areas where baitfish use is legal. Releases in areas where baitfish use is illegal are likely less than this. We anticipate that “bait bucket” introductions into stocking sites and/or other waters across the action area will occur over the time period covered by this consultation.

#### Conservation measures

AGFD has programs to educate the public about the risks to native species from illegal transport. Additional emphasis may be needed to reach portions of the public who do not usually come into contact with those programs.

#### Summary

This route is expected to continue to result in illegal transport of unwanted aquatic organisms over the 10-year term of the consultation.

#### Route 12: Transport of bullfrogs to create harvestable populations

Bullfrogs are a continuing concern for native leopard frogs, gartersnakes, and small native fish species. Bullfrogs are a game species in Arizona, and there are legal possession limits and methods of take. It is illegal to import, sell or transport, or release live bullfrogs in Arizona. Illegal creation of new populations by moving bullfrogs to stock tanks or small ponds does occur to create populations of adults for hunting purposes. Since bullfrogs are highly mobile, infestation of one site can lead to colonization of aquatic habitats elsewhere in the drainage. Bullfrogs are already found throughout most of Arizona; however, the establishment of new

populations remains a conservation concern for native frogs, gartersnakes, and fish for both predation and disease transmission.

#### Conservation measures

AGFD has programs to educate the public about the risks to native species from illegal transport of bullfrogs. Additional emphasis may be needed to reach portions of the public who do not usually come into contact with those programs.

#### Summary

This route is expected to continue to result in illegal transport of bullfrogs over the 10-year term of the consultation.

#### CONCLUSION FOR AREA-WIDE ANALYSIS

The continuing introduction and spread of unwanted aquatic species via the routes described in this analysis is a threat to all consultation species, whether from the proposed action or cumulative effects. The environmental baseline contains significant adverse effects from the introduction these nonnative species and those effects will continue into the future. Additional introductions are likely through the various routes discussed above. The ability of the extant protocols to address illegal transport, illegal or inadvertent introductions via commercial shipments, and the other routes described above are limited by enforcement and detection capability, particularly to address the introductions outside of legal permits.

AGFD has committed to continue its efforts toward reducing the introduction and spread of unwanted aquatic species through their ongoing programs and review of those programs in the conservation measures that are part of the Program. The presence of other conservation programs (such as the CAP program and the Horseshoe/Bartlett HCP [SRP 2008]) to address the impacts of unwanted aquatic organisms on native species provides benefits to the native species through establishment of secure populations and other directed activities. The additional efforts through the conservation plan included in the proposed action will first address the effects of the proposed sportfish stocking, and, through reductions of stressors, will reduce the baseline effects on consultation species and other special status species covered by the CAMP. Improved public outreach on the dangers of illegal transport may also assist in reducing the scope of the problem; however, the members of the public most likely to be involved in illegal transport likely already know such actions are illegal, so other measures may be needed.

After reviewing the current status of the listed, candidate, and likely candidate species and their designated or proposed critical habitat, the environmental baseline for the action area, effects of the proposed action on the area-wide scale, and the cumulative effects, it is the AESO's biological opinion that the implementation of the proposed action, including conservation measures that are part of the proposed action, is not likely to jeopardize the continued existence of any consultation species or result in destruction or adverse modification of designated or proposed critical habitat.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead we have relied on the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

We present this conclusion for the following reasons:

- For hatchery stockings (Routes 1-2), sufficient operational protocols are or will be in place to reduce the risk of inadvertent transport of unwanted aquatic organisms via stocking operations associated with the proposed action.
- For other legal importations of aquatic species (Routes 3 and 8-10), while the operational protocols are not quite as effective, commitments to improve oversight of these routes that are part of the proposed action contribute to reducing the risks below current levels.
- For inadvertent transport of unwanted aquatic organisms via Routes 4 and 5, operational protocols in place for AGFD field employees and existing public education programs contribute to reducing risks below current levels.
- For incremental effects associated with deliberate transport of unwanted aquatic organisms (Routes 7, 8, 11, 12), these actions are already illegal under Arizona law and regulation. AGFD provides educational materials in the Fishing Regulations booklet concerning those laws, and as part of the proposed action, the display of those topics in the booklet will be improved to provide easier access for the public. Other programs to educate the public are ongoing and additional efforts to expand those programs are planned. Unfortunately, the members of the public most likely to engage in illegal transport are likely aware that it is illegal, and continuing enforcement is required. We do not expect this level of illegal activity to increase substantially over the 10-year period covered by this consultation because the proposed action is primarily the ongoing stocking of existing sites and species with relatively few new species or locations. At its present rate there will be additional adverse effects to consultation species, but the proposed action is not likely to result in jeopardy when placed against the background of these cumulative effects and the consultation species’ status.
- The proposed action contains on the ground conservation measures that include the reduction of stressors in their habitats. At least some of the stressors to be addressed will be unwanted aquatic organisms, and removal of these at specific sites will improve the status of the consultation species.
- The conservation measures in the Program include information and education outreach intended to reduce effects associated with Routes 1-12.
- Ongoing conservation programs associated with AGFD activities and independent of them are continuing to support recovery of many consultation species.

### **INCIDENTAL TAKE STATEMENT**

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to

listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

In determining if incidental take is likely to occur as a result of a proposed action, two conditions must be met; the listed species must be reasonably certain to occur in the location where the take would occur, and, the proposed action must be reasonably certain to result in take. In determining whether or not incidental take would occur at each stocking site, our analysis first considered if both conditions were met.

We are unable to meet the two conditions for incidental take in regard to the actions included under the Area-Wide analysis. We can describe the effect of the take in terms of increased predation, competition, and disease transmission; however, we cannot assess when, where, how, how often, or to what consultation species the take would occur. We are also unable to determine the proportion of take attributable to the proposed action versus that which is ongoing due to cumulative effects to segregate that portion of the take. The number of events of inadvertent or illegal transport of unwanted aquatic organisms likely to occur over the 10-year period covered by this consultation is unknown, and, even when detected, may or may not be attributable to the proposed action. The effects of anglers on habitat or individuals of aquatic species are more focused; however, detection of events or locating individual animals that were harmed is unlikely. For the terrestrial species included in this consultation, the individual species site-specific analysis contains a discussion of the potential for take so that is not included here, as is angler by-catch for headwater chub. Thus, we cannot meet either condition.

The proposed action includes conservation measures to increase public awareness of the adverse effects to native aquatic species from illegal or inadvertent transport of unwanted aquatic species, and while these are not completely effective in removing this threat, there is a continuing benefit from these programs.

#### Migratory Bird Treaty Act

The FWS will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

#### CONCLUSION FOR CONSULTATION

After reviewing the current status of the listed, candidate, and likely candidate species and their designated or proposed critical habitat, the environmental baseline for the action areas, effects of

the proposed action (both site-specific and area-wide) and the cumulative effects, it is the AESO's biological opinion that the implementation of the proposed action, including conservation measures that are part of the proposed action, is not likely to jeopardize the continued existence of any consultation species considered in these analyses, nor is it likely to destroy or adversely modify any designated or proposed critical habitat.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead we have relied on the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Our conclusions in the individual species site-specific and area-wide analyses are the basis for this overall finding. The intent of the conservation plan included as part of the proposed action is to improve the status of the consultation species over the next 10-year period beyond what that status is today. Implementation of the conservation program will address existing adverse effects to species, and work to reduce the risk of additional adverse effects occurring.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The AESO and WSFR worked extensively with AFGD to identify potential conservation actions for inclusion in the CAMP included in the proposed action. In addition to the commitments in that plan, AGFD will continue to work toward the recovery of the consultation species and other native wildlife in Arizona. We have not identified any additional conservation recommendations specific to this consultation beyond those identified in the individual species analyses, as the overall efforts of AGFD provide significant benefits.

### **REINITIATION NOTICE**

#### *Non-listed species*

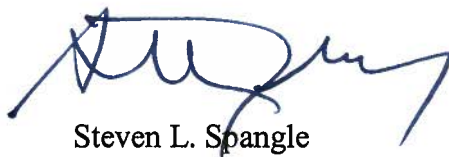
This concludes the conference for this proposed action. You may ask the AESO to confirm the conference opinion as a biological opinion issued through formal consultation if the proposed species is listed or critical habitat is designated. The request must be in writing. If the AESO reviews the proposed action and finds there have been no significant changes in the action as planned or in the information used during the conference, the AESO will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary. At the time of your request, the AESO will also evaluate the proposed effects of the action to determine if incidental take may occur.

After listing as threatened or endangered and any subsequent adoption of this conference opinion, the Federal agency shall request reinitiation of consultation if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect the species in a manner or to an extent not considered in the conference opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the species that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

#### *Listed species*

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR ' 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Completion of this formal consultation required an enormous commitment of time and resources by AGFD, WSFR, and AESO over almost a three-year period. The professionalism of the agencies' staff involved in this effort showed their dedication to all aquatic resources in Arizona, and this complex consultation could not have been accomplished without their efforts. For further information please contact Lesley Fitzpatrick (602-242-0210 x236) or me (602-242-0210 x244). Please refer to consultation number 22410-2008-F-0486 in future correspondence concerning this project.



Steven L. Spangle

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## **Appendix A**

### **Action Area Definition and Species List Development**

The development of the list of consultation species and the action area for the consultation was an ongoing effort driven by the particular characteristics of the proposed action. Since these components of the biological and conference opinion (BCO) are dependent on one another, their development is discussed together.

#### Development of the species list

The Fish and Wildlife Service's Wildlife and Sport Fish Restoration (WSFR) program requested a species list for this consultation on August 19, 2008. The Arizona Ecological Services Office (AESO) responded with a list of species on September 9, 2008. Arizona Game and Fish Department (AGFD), the designated applicant in the consultation, was also involved with development of the species list. As discussed under the action area determination, only species in Arizona were considered for inclusion.

The September 9, 2008, list was developed looking at all listed, proposed, candidate, as well as species under FWS consideration for candidate status in Arizona. Species were removed from consideration if the potential for interactions with stocked sport fish or their progeny or anglers pursuing stocked sportfish or their progeny was not likely to require further consideration due to lack of exposure to stocked sportfish, their progeny, or anglers. Also on the list were species under conservation agreements that may be in the vicinity of stocking sites and could be affected by the proposed action through exposure to stocked sportfish, their progeny, or anglers. AESO noted that the list was subject to modification as specific stocking sites were identified during the consultation process or as evaluation of effects of the action refined the appropriate action area.

During discussions from September 2008 to September 2009, the original list of species was informally modified by AESO, WSFR, and AGFD based on discussions on connectivity of stocked waters with other waters in Arizona. Some species on the original list, for example the Zuni bluehead sucker, were removed from consideration because their extant populations were sufficiently isolated from stocking sites or connected waters such that exposure to stocked fish, their progeny, or anglers was not likely to occur.

The original September 9, 2008, species list did recognize that the act of stocking sportfish could be a vector for transport of nonnative invasive species, parasites, or diseases to native species habitats. These organisms include fish, amphibians, reptiles, mollusks (New Zealand mud snail, quagga mussels), and crustaceans (crayfish, mitten crabs) that are of themselves injurious to native species and/or may transmit parasites or diseases. These species are hereinafter referred to as unwanted aquatic organisms. This concept was refined between September 2008 and September 2009, to look more closely at the potential for unwanted aquatic organisms and/or parasite or disease transmission that could be related to the sportfish stocking program.

Between October 26, 2009 and March 2010, AESO examined the two species lists and evaluated

the potential for any exposure to direct or indirect effects of the proposed action for all listed, proposed, candidate, and 10j species in Arizona. We also include in these tables species under FWS consideration for candidate status in Arizona. Since these species under candidate consideration may, within the time period covered by the consultation, become candidates for listing, we determined if there could be effects from the proposed action that might require future evaluation. Our evaluation indicated that the Wright's marsh thistle, northern leopard frog, the Sonoran population of the desert tortoise, and narrow headed garter snake warranted an assessment of potential effects from the proposed action.

### Action area

The determination of the action area for this consultation required evaluation on two levels; the individual species site-specific for direct and indirect effects from stocking actions at stocking sites, and the area-wide to address direct and indirect effect of the proposed action, as well as interrelated and interdependent effects relating to illegal and inadvertent transport of unwanted aquatic organisms related to the proposed action. The individual species site-specific action area is the hydrologically connected watershed associated with a particular stocking site that extends beyond the stocking site to other waters that could be accessed by stocked sportfish due to the hydrologic connections. The individual species site-specific action area also includes the terrestrial areas adjacent to the stocking site that are used by anglers to access the site to fish for stocked sportfish. The connectivity analyses in the stocking complex discussions in the Biological Assessment define the action area for each stocking site and, if appropriate, the complex as a whole. Generally, this information will be summarized in the analyses in the BCO with the full discussion incorporated by reference.

The area-wide action area is much broader due to the potential for unwanted aquatic organisms to be introduced to stocking sites by the proposed action or to move or be moved away from the stocking sites. The area-wide action area encompasses all the site-specific action areas, and the larger watersheds that include them. Hydrologically connected and isolated waters in those watersheds are included since illegal movement of unwanted aquatic organisms is an interdependent activity that does not require waters to be connected since the movement is facilitated by people.

Because of the uncertainty of occurrence for effects from actions related to the proposed action in Arizona reaching other adjacent waterways or states, AESO did not include watersheds outside of Arizona that did not contain stocking sites in the watershed. We acknowledge the issue within watersheds in Arizona based on natural connectivity, distances between native species habitat and stocking sites, past history of movement of nonnative species to native species habitats, and the likelihood of anglers or other people that access stocking sites for stocked sportfish or their progeny also accessing the listed-species habitats.

The illegal and/or inadvertent movement of unwanted aquatic organisms is a nationwide issue that is of significant concern for native fish and wildlife assemblages. Our decision to contain our analysis of this issue to watersheds within Arizona does not downplay the regional significance of the issue, but we were unable to reasonably evaluate the potential for out-of-state transfer of unwanted aquatic organisms connected to the proposed action of stocking sportfish

into Arizona. None of the unwanted aquatic organisms currently of concern in the southwestern United States is found only in Arizona; and the multiple potential routes/vectors between states and watersheds does not enable reasonable evaluation of the issue in context of the proposed action. New unwanted aquatic organisms of nationwide concern are likely to develop in the next 10-years. The introduction of any new unwanted aquatic organism into Arizona related to the proposed action could be cause for reinitiation, with the effects analysis on the appropriate scale conducted at that time.

#### Species categories for section 7 consultation on the proposed action

The tables below divide the list of Arizona species into categories based on the potential for effects from the proposed action. Tables 1-2 contain the lists of native species to be specifically considered in this consultation for direct and indirect effects and interdependent actions. The aquatic species were included in Table 1 because they are physically located in a proposed stocking reach or their occupied habitat is hydrologically connected to a stocking reach that allows for exposure to stocked sportfish to occur. Non-aquatic native species that have habitats that may be affected by angler access to stocking sites are in Table 2. These species are evaluated on a species-by-species basis in the (BCO) individual species site-specific analysis and, for native aquatic species, globally in the area-wide analysis for effects due to illegal or inadvertent movement of unwanted aquatic species.

Table 1: List of aquatic species found in Arizona considered in biological and conference opinion with initial determination of “may affect” for exposure to stocked sportfish or their progeny and illegal transport of nonnative organisms, parasites or diseases.

| Common Name               | Scientific Name                               | ESA Status | Critical Habitat <sup>1</sup> |
|---------------------------|-----------------------------------------------|------------|-------------------------------|
| Page springsnail          | <i>Pyrgulopsis morrisoni</i>                  | C          |                               |
| Three Forks springsnail   | <i>Pyrgulopsis trivialis</i>                  | C          |                               |
| Apache trout              | <i>Oncorhynchus apache</i>                    | T          |                               |
| Bonytail                  | <i>Gila elegans</i>                           | E          |                               |
| Colorado pikeminnow       | <i>Ptychocheilus lucius</i>                   | 10j        |                               |
| Desert pupfish            | <i>Cyprinodon macularius</i>                  | E          |                               |
| Gila chub                 | <i>Gila intermedia</i>                        | E          | Yes                           |
| Gila topminnow            | <i>Poeciliopsis occidentalis occidentalis</i> | E          |                               |
| Gila trout                | <i>Oncorhynchus gilae</i>                     | T          |                               |
| Headwater chub            | <i>Gila nigra</i>                             | C          |                               |
| Humpback chub             | <i>Gila cypha</i>                             | E          | Yes                           |
| Little Colorado Spinedace | <i>Lepidomeda vittata</i>                     | T          | Yes                           |
| Loach minnow              | <i>Tiaroga cobitis</i>                        | T          | Yes                           |
| Razorback sucker          | <i>Xyrauchen texanus</i>                      | E          | Yes                           |
| Roundtail chub            | <i>Gila robusta</i>                           | C          |                               |

|                               |                                           |                                 |          |
|-------------------------------|-------------------------------------------|---------------------------------|----------|
| Spikedace                     | <i>Meda fulgida</i>                       | T                               | Yes      |
| Woundfin                      | <i>Plagopterus argentissimus</i>          | 10j                             |          |
| Arizona treefrog-Huachuca DPS | <i>Hyla wrightorum</i>                    | C                               |          |
| Chiricahua leopard frog       | <i>Lithobates (= Rana) chiricahuensis</i> | T                               | Proposed |
| Northern leopard frog         | <i>Lithobates (= Rana) pipiens</i>        | 12-month finding in preparation |          |
| Sonoran tiger salamander      | <i>Ambystoma malvortium stebbinsi</i>     | E                               |          |
| Narrow-headed garter snake    | <i>Thamnophis rufipunctatus</i>           | Potential candidate             |          |
| Northern Mexican garter snake | <i>Thamnophis eques megalops</i>          | C                               |          |

Table 2: List of non-aquatic species found in Arizona considered in biological and conference opinion with initial determination of “may affect” due to anglers accessing stocking sites.

| Common Name                     | Scientific Name                            | ESA Status | Critical Habitat <sup>11</sup> |
|---------------------------------|--------------------------------------------|------------|--------------------------------|
| Bald eagle, Sonoran DPS         | <i>Haliaeetus leucocephalus</i>            | Delisted   |                                |
| Mexican gray wolf               | <i>Canis lupus baileyi</i>                 | 10j        |                                |
| Mexican spotted owl             | <i>Strix occidentalis lucida</i>           | T          | Yes                            |
| Mount Graham red squirrel       | <i>Tamiasciurus hudsonicus grahamensis</i> | E          |                                |
| New Mexico meadow jumping mouse | <i>Zapus hudsonius luteus</i>              | C          |                                |
| Southwestern willow flycatcher  | <i>Empidonax traillii extimus</i>          | E          | Yes                            |
| Yellow-billed cuckoo            | <i>Coccyzus americanus</i>                 | C          |                                |
| Yuma clapper rail               | <i>Rallus longirostris yumanensis</i>      | E          |                                |

Tables 3 and 4 contain the lists of aquatic species that are not directly affected by the proposed action, but are under consideration for the area-wide analysis of illegal and inadvertent movement of unwanted aquatic species. Table 3 species are those where background information on the species suggested an ongoing significant concern for exposure to unwanted aquatic species and these are included for the area-wide analysis. Table 4 species are those where background information on the species did not suggest an ongoing significant concern for

<sup>1</sup> Species may have critical habitat in Arizona, however, unless there could be effects to critical habitat, this space is left blank

exposure to unwanted aquatic species, or the circumstances of their location indicate that exposure to unwanted aquatic organisms related to the proposed action is not identifiable at this time. Table 4 species are not included in the area-wide analysis.

Table 3: List of aquatic species found in Arizona considered in biological and conference opinion with initial determination of “may affect, likely to adversely affect” for potential effects of the illegal transport by anglers and other persons of stocked species or their progeny that may also transfer parasites or diseases but are not otherwise affected by stocking actions.

| Common Name          | Scientific Name                            | Status    | Discussion                                                                                                                                                                                                                                                                                                                                                  |
|----------------------|--------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quitobaquito pupfish | <i>Cyprinodon eremus</i>                   | E with CH | Only natural population in United States is in Quitobaquito Spring pond. Nonnative fish (bullheads, golden shiner) were illegally introduced in the past. Golden shiner is a legal bait fish species for stocking sites on the lower Gila and lower Colorado rivers.                                                                                        |
| Sonora chub          | <i>Gila ditaenia</i>                       | T with CH | Stocked species (largemouth bass and bluegill) documented in California Gulch. Bait species (green sunfish, goldfish, and mosquitofish) documented in California Gulch. Bait species (green sunfish, mosquitofish) documented in Sycamore Canyon. Nonnative fish identified as concern in recovery plan (USFWS 1992) for predation and spread of parasites. |
| Sonoyta mud turtle   | <i>Kinosteron sonoriense longifemorale</i> | C         | No nonnative species large enough to consume turtles or their eggs is known from Quitobaquito Spring Pond. However, concerns exist for the illegal introduction of bullfrogs, crayfish, and large predatory fish (largemouth bass) (USFWS 2009c)                                                                                                            |

Table 4: Aquatic species in Arizona unlikely to be affected by direct or indirect effects of the proposed action and a reasonable analysis of the risks of exposure to unwanted aquatic species to allow for evaluation could not be made. This analysis was completed prior to the completion of the BA, so these species are not mentioned in that document.

| Common Name          | Scientific Name              | Status | Rationale                                                                                                                                                                                                                                                      |
|----------------------|------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Huachuca springsnail | <i>Pyrgulopsis thompsoni</i> | C      | Aquatic dependent but not found in areas where stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers or others that pursue stocked sportfish or their progeny. Nonnative species were not |



|                            |                                  |           |                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|----------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |                                  |           | identified as a threat in the most recent candidate form (USFWS 2009a).                                                                                                                                                                                                                                                                                                                             |
| San Bernardino springsnail | <i>Pyrulopsis bernardina</i>     | PE        | Found in one spring at Slaughter Ranch near San Bernardino NWR. Ranch is a park with open access to the pond near the spring, and there is a risk of introduction of nonnative species, but not likely from the proposed action as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk.                            |
| Stephan's riffle beetle    | <i>Heterelmis stephani</i>       | C         | Aquatic dependent but not found in areas where stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sportfish or their progeny. Nonnative species introductions not identified as a threat in the most recent candidate form (USFWS 2009b).                                                               |
| Beautiful shiner           | <i>Cyprinella formosa</i>        | T with CH | Access to populations on the San Bernardino NWR is restricted and there is no fishing allowed, limiting the incentive to move fish here or establish bait populations. Past introduction of Asian tapeworm via nonnative fish species indicates that there is connectivity in a global sense with aquatic populations elsewhere.                                                                    |
| Virgin River chub          | <i>Gila seminuda</i>             | E with CH | Found only in the Virgin and Muddy rivers in northern Arizona, eastern Nevada, and southern Utah. Risk of exposure to stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sportfish or their progeny, or other illegal movement of disease or parasite vectors in Arizona, is not reasonably identified. |
| Woundfin                   | <i>Plagopterus argentissimus</i> | E with CH | Found only in the Virgin River in northern Arizona, eastern Nevada,                                                                                                                                                                                                                                                                                                                                 |

|               |                         |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------|-------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |                         |           | and southern Utah. Risk of exposure to stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sportfish or their progeny, or other illegal movement of disease or parasite vectors in Arizona, is not reasonably identified.                                                                                                                                                                                                                                                                                                                                                                                                                |
| Yaqui catfish | <i>Ictalurus pricei</i> | T with CH | Extant and proposed populations on San Bernardino and Leslie Canyon NWRs and at Safe Harbor sites on Leslie Creek and HCP sites on West Turkey Creek have low risks of nonnative introductions due to limited access (private land) and no extant fishing opportunity. West Turkey Creek already contains nonnative fish species and is closed to fishing, reducing incentive for illegal stockings of sportfish or bait fish. Population at House Pond on the Slaughter Ranch is at higher risk due to open access to pond by visitors; but exposure risk from the proposed action is low as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk. |
| Yaqui chub    | <i>Gila purpurea</i>    | E with CH | Extant and proposed populations on San Bernardino and Leslie Canyon NWRs and at Safe Harbor sites on Leslie Creek and HCP sites on West Turkey Creek have low risks of nonnative introductions due to limited access (private land). West Turkey Creek already contains nonnative fish species and is closed to fishing, reducing incentive for illegal stockings. The population at House Pond on the Slaughter Ranch is at higher risk due to open access to pond by visitors; but exposure risk from the proposed action is low as there is no fishing or reasonable access to retrieve baitfish. Non-                                                                                                                           |

|                      |                                              |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------|----------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                              |   | stocked species released by general public comprises most of risk.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Yaqui topminnow      | <i>Poeciliopsis occidentalis sonoriensis</i> | E | Extant and proposed populations on San Bernardino and Leslie Canyon NWRs and at Safe Harbor sites on Leslie Creek have low risks of nonnative introductions due to limited access (private land). The population at House Pond on the Slaughter Ranch is at higher risk due to open access to pond by visitors; but exposure risk from the proposed action is low as there is no fishing or reasonable access to retrieve baitfish. Non-stocked species released by general public comprises most of risk.                                               |
| Zuni bluehead sucker | <i>Catostomus discobolus yarrowi</i>         | C | Nonnative species not found in occupied areas in Kin Li Chee watershed, but fathead minnows were found downstream nearer to Ganado Lake. Use of live bait fish are not allowed by Navajo Nation at Ganado Lake located at the downstream end of the creek. Unlikely that sportfish or bait species connected to the proposed action would be moved to the Navajo Nation by anglers fishing in non-tribal areas. Green sunfish and fathead minnow identified as problems in New Mexico. Fishing on Navajo Nation requires separate tribal fishing permit. |
| Relict leopard frog  | <i>Lithobates (Rana) onca</i>                | C | Found only on Lake Mead National Recreation Area in springs and small seeps. Aquatic dependent but not found in areas where stocked fish, other species of concern, or disease/parasite vectors are likely to be introduced through actions of anglers that pursue stocked sportfish or their progeny, or other illegal movement of disease or parasite vectors in Arizona, is not reasonably identified.                                                                                                                                                |

Table 5 contains all other listed, proposed, or candidate species in Arizona which, after initial

consideration, were determined not to be affected by the proposed action. The table also contains the rationale for those determinations. This analysis was completed prior to the completion of the Biological Assessment, so these species are not mentioned in that document. These species are not considered further in this consultation.

Table 5: All other listed, proposed, or candidate species in Arizona determined not to be affected by direct or indirect effects of the proposed action and rationale for that determination.

| Common Name           | Scientific Name                           | Status | Rationale                                                                                                                                                                                                                                                                                   |
|-----------------------|-------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Black footed ferret   | <i>Mustela nigripes</i>                   | E      | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                                                                                                                                                  |
| Hualapai Mexican vole | <i>Microtus mexicanus hualpaiensis</i>    | E      | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                                                                                                                                                  |
| Jaguar                | <i>Panthera onca</i>                      | E      | Exposure risk for disturbance to individuals from anglers at/near stocking sites is unlikely due to developed nature of lakes proposed for stocking and normally high recreationist use of those sites that reduces likelihood of jaguar use of site.                                       |
| Lesser long-nosed bat | <i>Leptonycteris curasoas yerbabuenae</i> | E      | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                                                                                                                                                  |
| Ocelot                | <i>Leopardus (= Felis) pardalis</i>       | E      | Not aquatic or riparian dependent.<br>Exposure risk for disturbance to individuals from anglers at/near stocking sites is unlikely due to developed nature of lakes proposed for stocking and normally high recreationist use of those sites that reduces likelihood of ocelot use of site. |
| Sonoran pronghorn     | <i>Antilocapra americana sonoriensis</i>  | E      | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                                                                                                                                                  |
| California condor     | <i>Gymnogyps californicus</i>             | 10j    | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                                                                                                                                                  |
| Gunnison sage grouse  | <i>Centrocercus minimus</i>               | C      | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                                                                                                                                                  |
| Masked bobwhite       | <i>Colinus virginianus ridgewayi</i>      | E      | Not aquatic or riparian dependent.<br>No population in vicinity of proposed                                                                                                                                                                                                                 |

|                                    |                                                                               |           |                                                                                                                                                                                                              |
|------------------------------------|-------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    |                                                                               |           | stocking sites                                                                                                                                                                                               |
| Northern Aplomado falcon           | <i>Falco femoralis septentrionalis</i>                                        | 10j       | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Sprague's pipit                    | <i>Anthus spragueii</i>                                                       | C         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Desert tortoise (Mohave)           | <i>Gopherus</i> ( = <i>Xerobates</i> = <i>Scaptochelys</i> ) <i>agassizii</i> | T with CH | Not aquatic or riparian dependent.                                                                                                                                                                           |
| Desert tortoise (Sonora)           | <i>Gopherus</i> ( = <i>Xerobates</i> = <i>Scaptochelys</i> ) <i>agassizii</i> | C         | Not aquatic or riparian dependent. Populations in upland areas in general vicinity of some low elevation stocking sites. Individuals not likely to be found in association with aquatic or riparian habitats |
| New Mexico ridge-nosed rattlesnake | <i>Crotalus willardi obscurus</i>                                             | T with CH | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Tucson shovel-nosed snake          | <i>Chionactis occipitalis klauberi</i>                                        | C         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Kanab ambersnail                   | <i>Oxyloma haydeni kanabensis</i>                                             | E         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Acuña cactus                       | <i>Echinomastus erectocentrus</i> var. <i>acunensis</i>                       | C         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Arizona cliffrose                  | <i>Purshia subintegra</i>                                                     | E         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Arizona hedgehog cactus            | <i>Cehinocereus triglochidiatus</i> var. <i>arizonicus</i>                    | E         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Brady pincushion cactus            | <i>Pediocactus bradyi</i>                                                     | E         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |
| Canelo Hills ladies'-tresses       | <i>Spiranthes delitescens</i>                                                 | E         | Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species.                                         |
| Cochise pincushion cactus          | <i>Coryphantha robbinsorum</i>                                                | T         | Not aquatic or riparian dependent. No population in vicinity of proposed stocking sites                                                                                                                      |

|                                         |                                                           |           |                                                                                                                                                                      |
|-----------------------------------------|-----------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fickeisen plains cactus                 | <i>Pediocactus peeblesianus</i> var. <i>fickeiseniae</i>  | C         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Gierisch mallow                         | <i>Sphaeralcea gierischii</i>                             | C         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Huachuca water-umbel                    | <i>Lilaeopsis schaffneriana</i> ssp. <i>recurva</i>       | E with CH | Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species. |
| Holmgren (Paradox) milkvetch            | <i>Astragalus homgreniorum</i>                            | E         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Jones' cycladenia                       | <i>Cycladenis humilis</i> var. <i>jonesii</i>             | T         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Kearney blue star                       | <i>Amsonia kearneyana</i>                                 | E         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Lemmon fleabane                         | <i>Erigeron lemmonii</i>                                  | C         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Navajo sedge                            | <i>Carex specuicola</i>                                   | E with CH | Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species. |
| Nichol Turk's head cactus               | <i>Echinocactus horizonthalonius</i> var. <i>nicholii</i> | E         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Peebles Navajo cactus                   | <i>Pediocactus peeblesianus</i> var. <i>peeblesianus</i>  | E         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Pima pineapple cactus                   | <i>Coryphantha scheeri</i> var. <i>robustispina</i>       | E         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| San Francisco Peaks groundsel (ragwort) | <i>Packera franciscana</i>                                | T         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Sentry milk vetch                       | <i>Astragalus cremnophylax</i> var. <i>cremnophylax</i>   | E         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Siler pincushion cactus                 | <i>Pediocactus sileri</i>                                 | T         | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |

|                         |                            |   |                                                                                                                                                                      |
|-------------------------|----------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Welsh's milkweed        | <i>Asclepias welshii</i>   | T | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |
| Wright's marsh thistle  | <i>Cirsium wrightii</i>    | C | Aquatic dependent but introduction of stocked fish, other species of concern, or disease/parasite vectors is not identified as an issue of concern for this species. |
| Zuni (rhizome) fleabane | <i>Erigeron rhizomatus</i> | T | Not aquatic or riparian dependent.<br>No population in vicinity of proposed stocking sites                                                                           |

## Appendix B

### Concurrences

#### Introduction

A complete description of the final proposed action is found in the August 2, 2011 request for formal consultation, and other supporting documents developed to assist in evaluation of potential effects to listed species, proposed species, and candidate species. Documents developed to provide the basis for these determinations are found in Appendix E. Please refer to those documents for more complete information on species status and effects.

#### Arizona treefrog Huachuca/Canelo Distinct Population Segment (DPS)

Arizona treefrogs are found in the Huachuca Mountains near the stocking site at Parker Canyon Lake.

The proposed action is the stocking of warm and coldwater sportfish into Parker Canyon Lake as described in the proposed action over the 10-year period covered by the consultation.

We concur with your determination that the proposed action may affect, but is not likely to adversely affect the Arizona treefrog in the DPS for the following reasons:

- While there is a potential for individual Arizona treefrogs to access Parker Canyon Lake and be exposed to stocked sportfish or their progeny, based on habitat use by treefrogs, the likelihood of this is low. This effect is discountable.
- Stocked sportfish are not likely to access treefrog habitats since they are not hydrologically connected to Parker Canyon Lake. This potential effect is insignificant.
- Use of live bait fish and waterdogs is prohibited at Parker Canyon Lake. While use of waterdogs does occur illegally, the use is connected to illegally stocked sportfish species (largemouth bass, Northern pike) and not stocked sportfish, so there is no direct connection between the proposed action and use of waterdogs

However, the Arizona treefrog will be assessed in the larger discussion of the potential for diseases and parasites or vectors that transmit them that is part of the environmental baseline and cumulative effects analysis for illegal and inadvertent transport of unwanted aquatic organisms.

#### Colorado pikeminnow 10j

Colorado pikeminnow are presently stocked in the Verde River in the vicinity of Childs and Beasley Flats, which is located below the lowest Middle Verde stocking site (West Clear Creek).

The proposed action is the stocking of rainbow trout in the Middle Verde stocking sites (Middle Verde, Oak Creek, Wet Beaver Creek, and West Clear Creek) and the East Verde River stocking sites (East Verde River, Green Valley Lake) would occur as described in the proposed action at various seasons of the year depending on the particular stocking site as described in the proposed



action for the 10-year period covered by the consultation.

We concur with your determination that the proposed action may affect, but it not likely to adversely affect the Colorado pikeminnow 10j population for the following reasons:

- Colorado pikeminnow are stocked below the stocking reach, and recent survey data have only documented recaptured Colorado pikeminnow in the vicinity of the stocking reach and in Horseshoe Lake further downstream. Few stocked fish are likely to reach this area, so the effect is discountable.
- Rainbow trout are not likely to prey on the stocked-size Colorado pikeminnow, and there is no recruitment of Colorado pikeminnow in the Verde River that would provide small fish vulnerable to predation. Channel catfish that may escape from Green Valley Lake may, after residence in the Verde River, become large enough to prey on stocked Colorado pikeminnow; however, the number of such channel catfish is likely to be so low as to be an insignificant effect.

#### Desert pupfish

There are no direct effects to desert pupfish from the proposed action. Indirect effects could occur if desert pupfish from the conservation sites were to move out of those sites and be exposed to stocked sportfish or their progeny or if stocked sportfish or their progeny could reach the conservation sites. The conservation sites potentially affected are: the Phoenix Zoo and Desert Botanical Garden, and three sites in the Agua Fria River drainage (Larry Creek, Lousy Canyon, and Tule Creek).

We concur with your determination that the proposed action may affect, but is not likely to adversely affect the desert pupfish for the following reasons:

- The reintroduced desert pupfish are in habitats at the Phoenix Zoo and Desert Botanical Garden that are hydrologically isolated from the Phoenix metropolitan urban stocking sites and stocked sportfish are unlikely to reach the reintroduction sites.
- The reintroduced desert pupfish in Larry Creek, Lousy Canyon and Tule Creek in the Agua Fria River drainage and are separated from the Lynx and Fain lakes stocking sites by ephemeral reaches of their home streams and the Agua Fria River. Stocked sportfish are not able to access the reintroduction sites due to the presence of barriers to upstream movement from the Agua Fria River. While it is possible to describe the circumstances of hydrological connectivity that would result in desert pupfish and stocked sportfish being in the Agua Fria River at the same time, these occasions are likely to be extremely rare over the 10-year period covered by this consultation, and we do not expect desert pupfish to be exposed to stocked sportfish.

However, the desert pupfish will be assessed in the larger discussion of the potential for diseases and parasites or vectors that transmit them that is part of the environmental baseline and cumulative effects analysis for illegal and inadvertent transport of unwanted aquatic organisms.

#### Mexican spotted owl with critical habitat

Mexican spotted owl habitat, including portions of protected activity areas (PACs), buffers around PACs, and designated critical habitat is in proximity to 32 stocking sites in seven watersheds.

The proposed action is the stocking of sportfish into these 32 sites as described in the proposed action over the 10-year period covered by the consultation. There are no direct effects from the stocking action; effects are related to anglers moving through Mexican spotted owl habitats to access fishing sites.

We concur with your determination that the proposed action may affect, but is not likely to adversely affect the Mexican spotted owl and its designated critical habitat for the following reasons:

- The amount of human disturbance resulting from angler access to stocking sites during the Mexican spotted owl breeding season within and/or adjacent to PACs is insignificant and discountable. In addition, the key habitat components of Mexican spotted owl habitat will not be adversely affected by the proposed action.
- The amount of habitat disturbance resulting from anglers accessing the stocking sites will result in insignificant and discountable effects to PCEs.

#### Mexican wolf 10j

The nonessential experimental population of Mexican wolves exists in the Apache National Forest within the action area for this consultation

The proposed action is the stocking of a variety of warmwater and cold water fish species into sites in the Little Colorado River drainage and the Black River drainage as described in the proposed action over the 10-year period covered by this consultation. Direct effects to Mexican wolves or their habitat are not expected from the proposed action. Effects to Mexican wolves are limited to the potential for interactions between Mexican wolves and anglers pursuing stocked sportfish.

We concur with your determination that the proposed action may affect, but is not likely to adversely affect the Mexican wolf 10j population for the following reasons:

- Wolf-human interactions between recreationists (including anglers) are rare and have only resulted in one wolf mortality since 1998. That mortality was not caused by an angler. Additional mortalities relating to recreationists are likely to be insignificant.
- Absent inducements, Mexican wolves avoid people.
- In the final rule for establishment of the 10j population, provisions for people to legally harass wolves to scare them away from people, buildings, facilities, livestock, other domestic animals, and pets as long as the incident is reported to the USFWS within seven days. In the event of anglers encountering a wolf, they can legally (non-lethally) cause the wolf to leave the area without causing prohibited take. Thus, the probability for non-legal take is discountable.

Page springsnail

Page springsnails are found in springs in the Oak Creek drainage in the vicinity of Page Springs and Bubbling Springs Pond, including at Page Springs State Fish Hatchery.

The proposed action is the stocking of rainbow trout into Oak Creek as described in the proposed action over the 10-year period covered by this consultation. Stocked rainbow trout cannot access occupied Page springsnail habitat, and anglers pursuing stocked trout are not likely to enter occupied habitats. The risk of contamination of occupied habitat by nonnative snail species (such as New Zealand mud snail) through the proposed action is limited by implementation of Hazard Analysis and Critical Control Points (HACCP) plans at hatcheries and normal operational procedures for acceptance and movement of stocked fish.

We concur with your determination that the proposed action may affect, but is not likely to adversely affect the Page springsnail for the following reasons:

- Rainbow trout or anglers pursuing them are not likely to enter Page springsnail habitats so the potential for effects is insignificant.
- HACCP plans and standard hatchery operations reduce the direct risk of contamination of occupied Page springsnail habitat through the activities of the proposed action to a discountable level.

Quitobaquito pupfish and designated critical habitat

The Quitobaquito pupfish is an endangered species with designated critical habitat at Quitobaquito Springs and Pond on the Organ Pipe Cactus National Monument.

The proposed action is the stocking of warm and coldwater sportfish into five stocking sites on the lower Colorado and lower Gila rivers as described in the proposed action over the 10-year period covered by the consultation.

We concur with your determination that the direct effects of the proposed action may affect, but are not likely to adversely affect the Quitobaquito pupfish and its designated critical habitat for the following reasons:

- The pupfish habitat at Quitobaquito is hydrologically isolated from the stocking sites, and movement of stocked fish via connected waters is not likely to occur.
- There is very limited potential for the illegal or inadvertent movement of stocked sportfish or legal bait species by anglers from the stocking sites to Quitobaquito due to distance between the stocking sites and Quitobaquito, and limited usefulness of the aquatic habitats at Quitobaquito to establish baitfish populations or a usable fishery. These effects are insignificant.
- There is a very limited potential effect from non-anglers illegally or inadvertently moving stocked sportfish or legal bait to Quitobaquito due to the distance between any site that

stocked fish or legal bait species may reach from the stocking sites and Quitobaquito. These effects are discountable.

- Effects to the PBFs of critical habitat related to the presence of nonnative species in the habitat are, as described above, unlikely to occur. These effects are discountable.

However, the Quitobaquito pupfish will be assessed in the larger discussion of the potential for diseases and parasites or vectors that transmit them that is part of the environmental baseline and cumulative effects analysis for illegal and inadvertent transport of unwanted aquatic organisms.

#### Sonora chub and designated critical habitat

The Sonora chub is a threatened species with designated critical habitat in the Sycamore Creek drainage, Rio Magdalena in Pima County, Arizona.

The proposed action is the stocking of warmwater sportfish species into Arivaca Lake and rainbow trout into Peña Blanca Lake as described in the proposed action over the 10-year period covered by the consultation.

We concur with your determination that the direct effects of the proposed action may affect, but are not likely to adversely affect the Sonora chub and its designated critical habitat for the following reasons:

- Sonora chub habitat in Sycamore Creek and California Gulch is hydrologically isolated from the stocking sites and movement of stocked fish via connected waters is not likely to occur.
- There is some potential for illegal or inadvertent movement of stocked sportfish from the stocking sites to Yank Tank; however, no individuals of stocked species have been documented in the tank or in Sycamore Creek. Individuals of stocked species (bluegills) in California Gulch may have come from in-watershed sources. These potential effects are discountable.
- Live bait fish are not allowed for fishing at either stocking site, limiting the impetus for anglers to establish bait fish populations at Yank Tank. Waterdogs are legal for fishing at the two stocking sites; however, waterdogs are generally not used by anglers for the sportfish species proposed for stocking, so there is limited impetus to establish waterdog populations for angling related to the proposed action. These potential effects are discountable.
- Effects to the Primary Constituent Elements of critical habitat related to the presence of nonnative species in the habitat are, as described above, unlikely to occur. These effects are discountable.

However, the Sonora chub will be assessed in the larger discussion of the potential for diseases and parasites or vectors that transmit them that is part of the environmental baseline and cumulative effects analysis for illegal and inadvertent transport of unwanted aquatic organisms.

#### Sonoyta mud turtle

The Sonoyta mud turtle is a candidate species at Quitobaquito Springs and Pond on the Organ Pipe Cactus National Monument.

The proposed action is the stocking of warm and coldwater sportfish into five stocking sites on the lower Colorado and lower Gila rivers as described in the proposed action over the 10-year period covered by the consultation.

We concur with your determination that the direct effects of the proposed action may affect, but are not likely to adversely affect the Sonoyta mud turtle for the following reasons:

- The Sonoyta mud turtle habitat at Quitobaquito is hydrologically isolated from the stocking sites, and movement of stocked fish via connected waters is not likely to occur.
- There is very limited potential for the illegal or inadvertent movement of stocked sportfish or legal bait species by anglers from the stocking sites to Quitobaquito due to distance between the stocking sites and Quitobaquito, and limited usefulness of the aquatic habitats at Quitobaquito to establish baitfish populations or a usable fishery. These effects are discountable.
- There is a very limited potential effect from non-anglers illegally or inadvertently moving stocked sportfish or legal bait to Quitobaquito due to the distance between any site that stocked fish or legal bait species may reach from the stocking sites and Quitobaquito. These effects are discountable.

However, the Sonoyta mud turtle will be assessed in the larger discussion of the potential for diseases and parasites or vectors that transmit them that is part of the environmental baseline and cumulative effects analysis for illegal and inadvertent transport of unwanted aquatic organisms.

### Three Forks springsnail

Three Forks springsnail is a species proposed for listing with critical habitat. They are found in the Three Forks Springs and Boneyard Bog Springs near the Three Forks area of the East Fork Black River.

The proposed action is the stocking of several salmonid species into five stocking sites in the Black River Complex (Ackre Lake, Big Lake, Crescent Lake, East Fork Black River, and West Fork Black River) as described in the proposed action over the 10-year period covered by this consultation. None of the stocking sites include the area of the East Fork Black River closest to the tributary containing the Three Forks springsnail populations. The size of the spring and spring outfall areas occupied by the Three Forks springsnail are not sufficient to support salmonids, and none have been found in the occupied habitat. Anglers pursuing stocked sportfish are also not likely to access the occupied habitat since no fishing is available.

The risk of contamination of occupied habitat by nonnative snail species (such as New Zealand mud snail) through the proposed action is limited by implementation of Hazard Analysis and Critical Control Points (HACCP) plans at hatcheries and normal operational procedures for acceptance and movement of stocked fish.

We concur with your determination that the proposed action may affect, but it not likely to adversely affect the Three Forks springsnail for the following reasons:

- Stocked salmonids or anglers pursuing them are not likely to enter Three Forks springsnail habitats so the potential for effects to the species and proposed critical habitat is discountable.
- HACCP plans and standard hatchery operations reduce the direct risk of contamination of occupied Three Forks springsnail habitat through the activities of the proposed action to a discountable level.
- The use of HACCP plans related to hatchery stocking of trout reduce the risk of nonnative snails or other organisms to be transported to springsnail habitat via stocking actions.

#### Woundfin 10j

Woundfin were stocked in 2007 in the experimental population reach of the Hassayampa River near Wickenburg. The number of fish stocked (50) was low and establishment of a population based on one stocking of this size is questionable. It is unclear, based on the status of the woundfin range-wide, if additional fish to stock the Hassayampa River will be available over the next 10 years.

The proposed action is the stocking of warm and coldwater fish species as described in the proposed action over the 10-year period covered by the consultation into stocking sites in the Lower Salt River Complex and any Urban Fishing or Special Urban Lakes that are connected to Tempe Town Lake. During flood events from the Salt or the Verde rivers, stocked fish or their progeny may pass below Tempe Town Lake and arrive at the confluence with the Hassayampa River. If the Hassayampa River is also flooding, woundfin from the 10j population maybe displaced downstream to the confluence with the Gila River.

We concur with your determination that the proposed action may affect, but it not likely to adversely affect the woundfin 10j population for the following reasons:

- The current status of the 10j woundfin population in the Hassayampa is unknown; however it is likely that the population is small if it exists at all. That there is a population of woundfin present and available to be displaced downstream is discountable. If, during monitoring of the woundfin in the Hassayampa a population is identified, or additional stockings are made, this concurrence may need to be reconsidered.

#### Yellow-billed cuckoo

Yellow-billed cuckoo is a candidate species found in riparian areas during spring and fall migration and summer breeding seasons. They use dense cottonwood-willow and mesquite vegetation communities for nesting; migration habitat may be non-riparian or lower-quality riparian areas.

The proposed action is the stocking of warm and coldwater fish species as described in the

proposed action over the 10-year period into 13 sites; one in the Gila River drainage (Kearney Lake), one in the Little Colorado River drainage (Becker Lake), two in the Salt River drainage (Lower Salt River, Tempe Town Lake), one in the Santa Cruz River drainage (Patagonia Lake), and eight in the Verde River drainage (Deadhorse Lake, Goldwater Lake, Middle Verde River, Oak Creek, Watson Lake, West Clear Creek, Wet Beaver Creek, and Willow Creek Reservoir). There are no direct effects from the stocking action on yellow-billed cuckoo or their habitat. Indirect effects are from disturbance to nesting cuckoos from anglers accessing stocking sites and habitat degradation from the creation or maintenance of access routes through riparian vegetation to reach stocking sites.

We concur with your determination that the proposed action may affect, but is not likely to adversely affect the yellow-billed cuckoo for the following reasons:

- Habitat of the yellow-billed cuckoo is very dense and difficult to move through. This is likely to discourage anglers seeking access to stocking sites from creating new trails, instead using existing access through riparian areas or areas with fewer or no trees. Using existing access through riparian areas precludes their regeneration into yellow-billed cuckoo habitat. Further, habitat is not in the stocking site for nine of the 13 sites, and habitat degradation from anglers is not likely occurring at those points. At the other four sites, anglers are only part of the recreational use, and, where stocking is seasonal; they are not present all the time. As a conservation measure, WSFR and AGFD have agreed to evaluate potential effects to habitat and work with the Forest Service to address any issues. The effects to habitat are discountable and insignificant.
- Nesting yellow-billed cuckoos are present at only two sites (Deadhorse Ranch and Oak Creek) during the active stocking season, and at West Clear Creek and Wet Beaver Creek between the two stocking seasons (these two sites are stocked in spring and fall, not over the summer) but some anglers may be present at these sites during the breeding season. Nesting yellow-billed cuckoos are in dense habitat that is difficult to access, reducing the opportunity for anglers to get close to nests and cause disturbance. Yellow-billed cuckoos in heavily used recreation areas such as those under consideration likely nest away from trails and paths to avoid disturbances. The effects to yellow-billed cuckoos from disturbance are insignificant.

### Yuma clapper rail

The Yuma clapper rail is found in cattail marshes on rivers and lakes along the Colorado, Gila, and Salt rivers.

The proposed action is the stocking of sportfish into the Lower Salt River, Lower Gila River, and Colorado River/Parker to Yuma sites as described in the proposed action over the 10-year period covered by this consultation. There are no direct effects from the stocking action; effects are related to the behavior of anglers at the stocking sites that are adjacent to suitable habitat for Yuma clapper rails.

We concur with your determination that the proposed action may affect, but it not likely to adversely affect the Yuma clapper rail for the following reasons:

- Effects to habitat of Yuma clapper rails by anglers accessing shorelines by creating paths or trails through the marsh are unlikely to occur. Dense marsh of the type favored by Yuma clapper rails is difficult to move through, and where habitat is patchy, access is more easily gained at existing openings. Effects to habitat are insignificant.
- Noise disturbance from shore or boat anglers has not been identified as a threat to Yuma clapper rails. Occupied habitats are in areas where recreational activities, including angling, occur regularly. The stocking sites where noise disturbance may occur are all in areas with recreational activities. Further, occupied Yuma clapper rail habitat is not at the stocking sites, but is nearby. The attenuation of noise from the sites reduces any potential disturbance to discountable levels.



## **Appendix C**

### **CAMP and Proposed Stocking Actions**

## *Sport Fish Stocking Conservation & Mitigation Program*

### **Conservation and Mitigation Program (CAMP) Overview**

For over 40 years, the Arizona Game and Fish Department (AGFD) has provided significant management resources for the conservation of nongame wildlife. In 1967, the AGFD created a full time position for the management of nongame species, the first such state position in the nation. Since 1967 the AGFD has developed one of the most robust state nongame programs in the nation, with expenditures of several million dollars per year.

The AGFD recognizes that the ability to continue to provide sport fishing opportunities is closely tied to the continued conservation of native aquatic species. It is upon this foundation, and consistent with its long history of conservation, that the Department intends to reduce and offset impacts of the stocking program through implementation of the Sport Fish Stocking Conservation & Mitigation Program (CAMP). To implement the CAMP, AGFD will commit an average of \$500,000 per year for the 10 year CAMP period; a total commitment of \$5 million over 10 years. This \$5 million will be a net increase in funding over current funding of AGFD programs toward conservation of CAMP species. The intent of the CAMP is to not only offset impacts but to contribute to the recovery and conservation of CAMP species (see below).

### **CAMP Species**

CAMP includes activities targeted at both consultation species identified in the Draft Biological and Conference Opinion (DBCO) and additional other (non-consultation) sensitive aquatic species identified in the Environmental Assessment (EA). Collectively, these are termed the “CAMP Species.” CAMP Focal Species are those identified by DBCO that are federally listed or candidate species likely to be impacted by the stocking action (Table 1). Additional Conservation Species (ACS) are the other CAMP Species evaluated in the DBCO comprised of federally listed or candidate species whose future conservation status can have a direct bearing on future sport fish stocking activities (Table 2). Other non-consultation sensitive aquatic species addressed by CAMP are found in **Error! Reference source not found.**

**Table 1. DBCO CAMP Focal Species**

| <b>Species</b>                  | <b>ESA Status</b>                                          |
|---------------------------------|------------------------------------------------------------|
| Chiricahua leopard frog         | Threatened                                                 |
| Headwater chub                  | Candidate                                                  |
| Loach minnow                    | Threatened                                                 |
| Narrow-headed garter snake      | Potential Candidate <sup>12</sup>                          |
| Northern Mexican garter snake   | Candidate                                                  |
| New Mexico meadow jumping mouse | Candidate                                                  |
| Northern leopard frog           | Potential Candidate <sup>1</sup> ; 12 Month Review in prep |
| Roundtail chub                  | Candidate                                                  |

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<sup>12</sup> Species likely to be listed in the near future were evaluated in the DBCO.

**Table 2. DBCO CAMP Additional Conservation Species (ACS)**

| Species                        | ESA Status |
|--------------------------------|------------|
| Apache trout                   | Threatened |
| Bonytail chub                  | Endangered |
| Gila chub                      | Endangered |
| Gila topminnow                 | Endangered |
| Gila trout                     | Threatened |
| Humpback chub                  | Endangered |
| Little Colorado spinedace      | Threatened |
| Mount Graham red squirrel      | Endangered |
| Razorback sucker               | Endangered |
| Sonoran tiger salamander       | Endangered |
| Spikedace                      | Threatened |
| Southwestern willow flycatcher | Endangered |

**Table 3. Other non-consultation sensitive aquatic species**

|                        |             |
|------------------------|-------------|
|                        |             |
| Longfin dace           | S, SC       |
| Speckled dace          | S, SC       |
| Sonora sucker          | S, SC       |
| Desert sucker          | S, SC       |
| Little Colorado sucker | S, SC, WSCA |
| Bluehead sucker        | S           |
| Lowland leopard frog   | S, SC, WSCA |

S = U.S. Department of Agriculture Forest Service and/or Bureau of Land Management Sensitive

SC = U.S. Department of the Interior Fish and Wildlife Service Species of Concern

WSCA = Wildlife of Special Concern in Arizona

### **CAMP Approach**

CAMP Species currently are affected by a variety of human and natural caused threats on the landscape that impact both the species and their habitats. Examples of threats are habitat loss or degradation (including loss or reduction of surface water), predation/competition by non-native species and direct disturbance of individuals of a species by people. CAMP employs several approaches or tools that will be used to address the conservation needs of CAMP Species: 1) provide information that will help determine what actions are necessary for the conservation and recovery of CAMP Species or 2) directly implement conservation and recovery actions for CAMP Species. These tools include:

- Population inventory: systematic sampling of areas to assess species presence;
- Population or community monitoring: systematic sampling of populations to determine status and/or trend over time;
- Directed research: activities that focus on issues relating to CAMP Species to inform management actions (e.g. life history traits, habitat needs, reestablishment methods, sport fish interactions with program species);
- Address stressors: Identify and assess current and future key stressors to native aquatic wildlife populations that are, or may be, contributing to species declines. Collaborate with stakeholders to address, remove, minimize or reduce these key stressors;

- Reintroduction and augmentation: reintroduction or augmentation into historical range is a frequently used tool to recover species. Reintroductions are often coupled with construction of exclusion barriers and removal or suppression of nonnative species. Reintroductions and augmentations are implemented consistent with accepted guidelines such as George et al. (2009);
- Information, education, and outreach activities: includes signs, publications, promotions, and marketing activities intended to promote conservation stewardship by the public; and
- Guidelines: assessing, evaluating, and proposing modifications of guidelines or regulations that can protect or minimize threats to native aquatic species.

The fundamental concept of the CAMP is to provide aquatic community-based conservation actions that will benefit CAMP Species as well as other native species. Community-based conservation actions provide benefits to CAMP and other native species at the individual, population and watershed scales, and depending on location, can benefit multiple species at one time. Aquatic habitats available for conservation actions for CAMP Species are limited, thus, a community-based focus is critical to achieving CAMP goals and objectives. The tools used in this CAMP will often benefit multiple species in using this community-based approach. For example, reintroduction or augmentation actions will often include suppression or removal of nonnative species and salvage (and subsequent return) of existing native species prior to reintroduction of the target species benefitting the entire native aquatic community at the introduction site and possibly downstream and will also often include reintroduction of additional appropriate native species in order to establish a functional native community.

### **CAMP Definitions**

**Stressors** are identified in existing listing decisions, recovery plans or conservation agreements and are usually termed “**threats**” in most existing plans and agreements. Particular stressors that will be the focus of this program, and are most aligned with the AGFD’s authority, include nonnative predatory and competitive species, degraded habitat, and dewatered habitat or habitat with reduced flows. Addressing these may include eradicating, removing, or otherwise controlling non-native predatory and competitive species, restoring habitat, purchasing land, purchasing land with accompanying water rights, providing for instream flow protection, and other actions under the statutory authority of the AGFD. Reduction or removal of stressors on the landscape is a tool that has a range of benefits at both the local and broad scales. Removal of sources of nonnative species from the landscape (e.g. to facilitate introductions or to eliminate a watershed source, etc) minimizes impacts to native species at the site of removal and also minimizes downstream contributions of individuals that help maintain or augment resident nonnative populations.

**To secure a population** existing stressors (threats) would be removed or reduced to a level that would allow for the population to persist into the foreseeable future and contribute to recovery or conservation. The success of these actions will be evaluated based on a measurable improvement in population status (e.g. increase in numbers, distribution, or reproduction) and/or a measurable improvement in biological or physical characteristics (habitat) upon which the species depends (e.g. decreased numbers of nonnative competitor/predator species, decreased movement of

nonnative fish following installation of a barrier, increased or protected/secured water flows). The effectiveness of these actions in meeting the desired outcome of securing each of the populations committed to in the CAMP will be monitored by AGFD and the results evaluated by FWS and AGFD. This evaluation will consider the following five factors when determining whether the intended outcome of the action has been met. Not all five factors will be applicable to every evaluation.

1. A measurable reduction in the stressors that have recognized adverse effects or an improvement in biological or physical characteristics.
2. Species persistence over time.
3. Detection of new individuals recruiting into the population or multiple age classes present. For short-lived species such as loach minnow or leopard frogs, simple persistence for 3+ years would imply recruitment was occurring. For long-lived species presence of multiple size classes and/or other methods would be used to determine if recruitment was occurring.
4. Relative abundance through time where appropriate.
5. Detection of species beyond initial geographic extent where appropriate.

**To reintroduce a population** (and if needed, augment since most reintroductions require multiple stocking events) the species would be stocked into a location within the historical range where the species does not currently exist. The success of these actions will be evaluated on the degree to which a population is established (i.e. established would be self-sustaining without a need of further stocking, establishing/potentially establishing would be reproducing whereby additional stocking may still be needed, and not established would be no or insufficient reproduction to lead to a self sustaining population). Establishment of a population (self-sustaining or without a need for continued stocking) can take considerable time; therefore, it may not be possible to fully realize establishment within the timeframe of the CAMP implementation period. Therefore, by the end of the 10-year project timeframe the populations committed to must be determined to either be established or have shown sufficient progress towards becoming established by FWS AZESO. The effectiveness of reintroductions will be monitored by the AGFD and the results evaluated by FWS and AGFD. This evaluation will consider the following four factors when determining whether the intended outcome of the action has been met. Not all four factors will be applicable to every evaluation.

1. Species persistence since stocking.
2. Detection of new individuals recruiting into the population or multiple age classes present. For short-lived species such as loach minnow or leopard frogs, simple persistence for 3+ years without stocking would imply recruitment was occurring. For long-lived species presence of multiple size classes and/or other methods would be used to determine if recruitment was occurring.
3. Relative abundance through time since stocking where appropriate.
4. Dispersal beyond initial stocking locations where appropriate.

## Funding and Authority to Implement Mitigation

Guidance from the Council of Environmental Quality directs agencies to provide mitigation that is reasonably certain to occur. To reach that conclusion there must be a funding source and authority to accomplish the mitigation.

To implement the CAMP, AGFD will commit an average of \$500,000 per year for the 10 year CAMP period. There will be multiple funding sources for implementation of this program. Funding sources that may be used to support the CAMP include, but are not limited to, any combination of the following: Sport Fish Restoration Act funds, Arizona Heritage Fund, Game and Fish fund, Wildlife Conservation Fund, and other eligible funds. The AGFD's budget process is administered by the Arizona Game and Fish Commission (AGFC). Funding sources that are received by the AGFD and committed to other required mitigation projects, such as the Central Arizona Project, or funds specifically dedicated such as the National Fish and Wildlife Foundation for Apache trout will not count towards this CAMP funding.

Authority to manage and regulate wildlife, including fish, in Arizona is provided under Arizona Revised Statute (ARS) Title 17. ARS Title 17 also outlines AGFD and AGFC authorities related to funding, the taking, handling, and management of wildlife (including regulations and licenses), fish hatching, and fish culture.

Some of the actions (e.g., establishment of new populations) will be located on U.S.D.A. Forest Service (USFS) and possibly, Bureau of Land Management (BLM) managed lands. The AGFC has a Master Memorandum of Understanding (October 2, 2007) with the BLM that establishes the AGFD's authority to manage fish and wildlife populations. The Master MOU is backed by a Joint Policy Statement (August 25, 2008) that restates that the parties will work cooperatively to manage resources on public lands and that the AGFD's mandate to meet statutory trust responsibilities to manage fish and wildlife populations is supported by the BLM. The AGFC also has a master MOU with the USFS which recognizes the AGFC and AGFD as having primary responsibility for managing fish and wildlife populations consistent to state and federal laws.

In addition to these agreements, the AGFD holds a Federal Fish and Wildlife Permit which authorizes activities for scientific purposes or to enhance the propagation and survival of federally listed species (ESA § 10(a)(1)(A)). The AGFD also has ESA § 6 authorities to manage threatened and endangered species.

## Planning and CAMP Implementation

A 10-year planning document will be developed to guide annual work plans for actions included for mandatory activities as shown in **Error! Reference source not found.** and Table 5 in the next section that prioritize and identify resources necessary to accomplish all objectives. Within the parameters of the 10-year plan there will be annual work plans that will describe activities to be undertaken each year

The annual work plan will be developed by AGFD in concert with FWS (AESO and WSFR). The plan will be completed by July 1 annually and will identify specific actions which will be taken for CAMP Species in that year. The first Annual Work Plan will be completed within 90 days of the finalization of the FONSI.

These annual work plans will identify and prioritize species, activities, conservation tools, budget and staffing that will implement achievable conservation objectives, including specific

conservation actions or targets identified in **Error! Reference source not found.** and 3 for CAMP Species within the \$500,000 average annual CAMP budget. To the extent that funding is available in a particular year, conservation actions identified in Table 4 will be included in the annual work plan.

### CAMP Activities

Two tiers of CAMP activities have been identified: 1) a set of mandatory conservation/mitigation activities that include activities targeted at CAMP Focal DBCO species (**Error! Reference source not found.**), activities identified in the DBCO as either reasonable and prudent measures (RPMs) or mandatory conservation measures as part of the proposed action (**Error! Reference source not found.**), and activities targeted at non-consultation sensitive aquatic species identified in the EA (Table 5); and 2) an additional set of non-mandatory activities targeting CAMP Species that will be implemented depending on funding availability (Table 6).

Each year WSFR, the AESO, and the AGFD will identify **Error! Reference source not found.** and Table 5 activities for implementation that year. If funds remain after the **Error! Reference source not found.** and Table 5 activities are funded, activities from Table 6 will be implemented.

CAMP activities will be coordinated to achieve maximum benefit for all CAMP species. For each measure, the magnitude of benefits for a species will vary, and some species may benefit directly and some species may benefit indirectly with the end result that mitigation commitments for all species are met by the end of the 10-year implementation.

The success of the CAMP over its lifetime will depend on the use of adaptive management to inform decisions about the actions undertaken. Adaptive Management is a decision process that involves flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. This process provides managers with flexibility to make decisions and take actions that accommodate uncertainties and provide the ability to change direction when necessary to achieve conservation objectives. By assessing past outcomes, management will learn what actions will best achieve the conservation and recovery objectives of the CAMP.

Adaptive Management is a structured iterative approach to resource management employed by both the U.S. Fish and Wildlife Service (Williams et al. 2009) and the Arizona Game and Fish Department (AGFD Policy II.6). Generally, adaptive management consists of six steps that form a feedback loop: 1) assess problem/objective, 2) design an action, 3) implement an action, 4) assess outcomes, 5) evaluate achievement, and 6) adjust.

Every year, during the annual planning process, WSFR, AESO and AGFD will identify any modification of conservation actions that need to be taken due to unforeseeable/changed circumstances or new information (such as destruction of proposed reintroduction habitat, new threats identified, new tools/technology) that affect the effectiveness or the ability to complete those actions. In turn, the agencies will identify new actions that will replace or augment previously identified actions. These new measures will offset effects of the proposed action and will provide as close to, the same or better benefit as the actions that are modified or eliminated.

It is expected that the timelines identified for specific actions identified in this document will sometimes need to shift as the agencies go through this adaptive management process.

**Table 4. Mandatory ESA Conservation Measures. Note that many CAMP species, regardless of activity focus as identified in the table, will benefit from actions identified in both the ESA and NEPA analyses.**

| Species          | Conservation Measure                                                                                                                                       |                                               |                                                                                                                                                                                                 |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Multiple species | Within three years, the AGFD shall convert to triploid rainbow trout for all AGFD hatchery stockings with the exception of closed systems and urban lakes. |                                               |                                                                                                                                                                                                 |
|                  | The AGFD shall secure existing or reintroduce new conservation populations for Focal Species:                                                              |                                               |                                                                                                                                                                                                 |
|                  | Species                                                                                                                                                    | Number of populations secured or reintroduced | Estimated Timeframe                                                                                                                                                                             |
|                  | Chiricahua leopard frog                                                                                                                                    | 3                                             | Within four years begin stocking or securing one population; Within six years begin stocking or securing a second population; Within eight years begin stocking or securing a third population  |
|                  | Headwater chub                                                                                                                                             | 3                                             | Within three years begin stocking or securing one population; Within six years begin stocking or securing a second population; Within eight years begin stocking or securing a third population |
|                  | Roundtail chub                                                                                                                                             | 3                                             | Within two years begin stocking or securing one population; Within four years begin stocking or securing a second population; Within six years begin stocking or securing a third population    |
|                  | Loach minnow                                                                                                                                               | 2                                             | Within four years begin stocking or securing one population; Within six years begin stocking or securing a second population                                                                    |
|                  | Northern leopard frog                                                                                                                                      | 2                                             | Within four years begin stocking or securing one population; Within six years begin stocking or securing a second population                                                                    |



| Species                 | Conservation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                                                                                                                |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------|
|                         | <sup>13</sup> Northern Mexican garter snake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2 | Within five years begin stocking or securing one population; Within seven years begin stocking or securing a second population |
|                         | <sup>2</sup> Narrow-headed garter snake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2 | Within five years begin stocking or securing one population; Within seven years begin stocking or securing a second population |
|                         | Within three years, the AGFD shall conduct a statewide live bait (bait fish and tiger salamander) use assessment and risk analysis to develop recommendations to amend live bait management. The AGFD shall present these recommendations to the Arizona Game and Fish Commission for implementation consideration.                                                                                                                                                                                                                                             |   |                                                                                                                                |
|                         | Within three years, the AGFD shall review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper disposal of live bait species.                                                                                                                                                                                                                                                                                                                                    |   |                                                                                                                                |
|                         | Within three years, the AGFD shall review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.                                                                                                                 |   |                                                                                                                                |
| Apache trout            | The AGFD shall continue to work with partners to annually evaluate barrier conditions on Mineral Creek, South Fork Little Colorado River, and West Fork Little Colorado River, survey for nonnative fish in recovery streams following the established schedule, and repair barriers in these three streams as needed as part of the proposed action. <sup>14</sup>                                                                                                                                                                                             |   |                                                                                                                                |
| Chiricahua leopard frog | For warm-water sport fish stocking actions via contract vendors at sites where effects to Chiricahua leopard frogs are a concern, the “sensitive areas” HACCP plan shall be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan shall involve the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sport fish. Loads containing unwanted aquatic organisms shall be refused and not stocked. This measure will be implemented as needed. |   |                                                                                                                                |
|                         | For coldwater sport fish stocking actions at sites where effects to Chiricahua leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery shall be in place to reduce the risk of contamination of the fish to be stocked. This measure has been ongoing and will continue to be implemented. <sup>3</sup>                                                                                                                                                              |   |                                                                                                                                |

<sup>13</sup> Dependent upon available repatriation source, numbers, and protocols.

<sup>14</sup> Funds expended to implement these activities do not contribute to meeting the annual average funding requirement of \$500,000.

| Species        | Conservation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | Within three years, the AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Gila chub      | In two years during the 10-year period, the AGFD shall survey the occupied Gila chub habitat on public lands in Spring Creek above the barrier when habitat conditions are conducive to rainbow trout persistence. If any stocked rainbow trout are found, these shall be documented and removed from the stream and an additional survey to locate stocked rainbow trout shall be implemented in the following year. The first survey will be completed within three years.                                                                                                                                                                                                                                                                                                                                                                             |
| Headwater chub | The AGFD shall implement actions to increase angler awareness of headwater chub, including the fact that headwater chub is not a legal sport fish at the East Verde River and Haigler Creek stocking sites. This measure will be completed within three years of implementation of the proposed action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                | Headwater chub habitats in the East Verde River and Tonto Creek shall be considered priority areas for use of triploid rainbow trout to avoid augmentations to existing wild populations. This measure will be implemented within three years of implementation of the proposed action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                | In order to obtain information needed to implement conservation actions, the AGFD shall undertake an assessment of headwater chub populations in the East Verde River, Tonto Creek, and the Haigler Creek drainage to determine population structure and extent, nonnative species present as stressors, sites for potential reestablishment, and identification of specific research needs. This assessment shall tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for headwater chub and five other native fish species, because that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment shall serve as a guidance document for implementing conservation actions for the headwater chub. This assessment shall be completed within three years. |
| Roundtail chub | The AGFD shall, within the first two years of the CAMP, develop an assessment of opportunities across the range of the roundtail chub focusing on those with the greatest potential for conservation benefits for the species. This assessment shall tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for roundtail chub and five other native fish species, as that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment shall serve as a guidance document for implementing conservation actions for the roundtail chub.                                                                                                                                                                                                                           |
| Spikedace      | The AGFD shall continue monitoring of the Upper Verde River to evaluate native and nonnative fish populations. Any individuals of the stocked sport fish species captured during such monitoring shall be removed from the river. This measure will be implemented following the established schedule of once every three years.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

| Species                       | Conservation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Loach minnow                  | In the event of insufficient Apache trout to meet annual recreational stocking demands, the East Fork Black River shall be stocked with Apache trout after those recreational stocking sites associated with a recovery population (i.e., West Fork Black River, West Fork Little Colorado River at Sheeps Crossing, and Lee Valley Lake). Any rainbow trout that are stocked into the East Fork Black River shall be sterile triploids to avoid any augmentation to the reproducing population of rainbow trout in the East Fork Black River. This measure will be ongoing and will be implemented as needed. |
|                               | If a spill from Big Lake or Crescent Lake is anticipated, the AGFD shall install a fish weir to capture fish and prevent downstream movement. If the weir is not installed prior to a spill, a survey for nonnative trout species in the occupied habitat of the loach minnow shall be completed within that spring/summer season. All nonnative fish species encountered during that survey shall be removed. This measure will be implemented as needed.                                                                                                                                                     |
|                               | In coordination with partners, the AGFD shall develop and implement a standard survey schedule and procedures to evaluate fish community with emphasis on stocked trout presence in the loach minnow occupied areas of the East Fork Black River drainage. The first survey shall be completed by the third year.                                                                                                                                                                                                                                                                                              |
| Northern leopard frog         | For warm-water sport fish stocking actions via contract vendors at sites where effects to northern leopard frogs are a concern, the “sensitive areas” HACCP plan shall be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan shall involve the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sport fish. Loads containing unwanted aquatic organisms shall be refused and not stocked. This measure will be implemented as needed.                                                  |
|                               | For coldwater sport fish stocking actions at sites where effects to northern leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery shall be in place to reduce the risk of contamination of the fish to be stocked. This measure has been ongoing and will continue to be implemented as needed. <sup>3</sup>                                                                                                                                                                                                     |
| Sonoran tiger salamander      | The AGFD shall work with Federal, state, and private partners to identify and implement projects that reduce the risk of hybridization between Sonoran tiger salamanders and nonnative salamanders. This measure will be completed by year ten.                                                                                                                                                                                                                                                                                                                                                                |
|                               | Within three years, the AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.                                                                                                                                                                                                                                                                                                                   |
| Northern Mexican garter snake | Within three years, the AGFD shall develop outreach material on garter snakes to attempt to reduce the deliberate killing or injuring of garter snakes by the public. Materials developed for this program shall be posted at stocking sites that contain populations of garter snakes.                                                                                                                                                                                                                                                                                                                        |

| Species                    | Conservation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | <p>In providing for two garter snake populations either through securing existing but threatened populations or establishment of new conservation populations, a source for individuals to reestablish conservation populations is needed, as well as information on propagation, release options, and techniques for successfully securing existing threatened populations. Member organizations of the Garter snake Conservation Working Group have initiated applied research in these arenas, and the AGFD shall contribute to these types of efforts during the 10-year program. Once sufficient information is obtained on techniques to reestablish populations and/or secure existing threatened populations, the AGFD shall initiate the population reestablishment and/or securing actions. Within two years the AGFD will develop a plan to support and/or implement research in these arenas. Supporting and/or implementing this research will then follow the plan.</p> <p>As part of all native fish reintroduction efforts in Arizona, the AGFD shall ensure that renovated streams occupied by Northern Mexican garter snakes are quickly restocked with appropriate native fish species and native frog species that can provide prey for Northern Mexican garter snakes in order to not put stress on any garter snake population through elimination of its forage base. This measure will be implemented as needed.</p>                                                                                                                                                                                                                                                                  |
| Narrow-headed garter snake | <p>Within three years, the AGFD shall develop outreach material on garter snakes to attempt to reduce the deliberate killing or injuring of garter snakes by the public. Materials developed for this program shall be posted at stocking sites that contain populations of garter snakes.</p> <p>In providing for two garter snake populations either through securing existing but threatened populations or establishment of new conservation populations, a source for individuals to reestablish conservation populations is needed, as well as information on propagation, release options, and techniques for successfully securing existing threatened populations. Member organizations of the Garter snake Conservation Working Group have initiated applied research in these arenas, and the AGFD shall contribute to these types of efforts during the 10-year program. Once sufficient information is obtained on techniques to reestablish populations and/or secure existing threatened populations, the AGFD shall initiate the population reestablishment and/or securing actions. Within two years the AGFD will develop a plan to support and/or implement research in these arenas. Supporting and/or implementing this research will then follow the plan.</p> <p>As part of all native fish reintroduction efforts in Arizona, the AGFD shall ensure that renovated streams occupied by narrow-headed garter snakes are quickly restocked with appropriate native fish species that can provide prey for narrow-headed garter snakes in order to not put stress on any garter snake population through elimination of its forage base. This measure will be implemented as needed.</p> |
| Three Forks springsnail    | The AGFD shall continue to implement the HACCP plan for operations at state hatcheries and the transport of trout to the stocking sites in the Black River drainage. This measure has been ongoing and will continue to be implemented as needed. <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Mt Graham red squirrel     | The AGFD shall coordinate with the Coronado National Forest on traffic management that can reduce the risk of mortality to Mount Graham red squirrels from vehicles accessing Riggs Flat Lake as part of continuing implementation of the Mount Graham Red Squirrel Recovery Plan. This measure will be implemented as needed. <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Species                                                | Conservation Measure                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Little Colorado spinedace                              | The stocking restrictions and implementing actions from the 1995 (USFWS 1995) and 2001 (USFWS 2001) incidental take statements for CC Craigin Reservoir, Knoll Lake, and Nelson Reservoir, except for modified creel survey requirements, are part of the Proposed Action for this consultation and shall be implemented over the next 10 years as described in those documents. Creel surveys shall occur no less than once every 10 years. |
| Arizona treefrog, Huachuca Distinct Population Segment | Within three years, the AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful.                                                                                                                                                 |
| Bonytail chub<br>Razorback sucker                      | A barrier net shall be installed at the La Paz County Park Lagoon immediately prior to the stocking event and remain in place for seven days after the stocking event.                                                                                                                                                                                                                                                                       |
|                                                        | Prior to any stocking into La Paz County Park Lagoon, signs similar to those used on Lake Havasu shall be posted at the lagoon describing bonytail to anglers and informing them of what to do should they catch a bonytail. These signs shall remain in place as long as the barrier net is in place at the lagoon.                                                                                                                         |
| New Mexico meadow jumping mouse                        | The AGFD shall provide protection from human access impacts (completed within three years), and if needed, enhancement actions for meadow jumping mouse habitats on AGFD-owned lands on the West Fork Black River (if needed, completed within five years).                                                                                                                                                                                  |
|                                                        | The AGFD shall coordinate with the Apache–Sitgreaves National Forests on evaluations of effects to meadow jumping mouse habitat along the East and West Forks of the Little Colorado River. This measure will be implemented as needed.                                                                                                                                                                                                      |

**Table 5. Mandatory NEPA Mitigation Measures.** Note that many CAMP Species will benefit from actions identified in both the ESA and NEPA analyses.

|                                                       | <b>ion Action</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other special status aquatic and semi-aquatic species | <p>The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species through the removal of key stressors. The AGFD shall address two stressors impacting these species and associated aquatic communities within each of the following sub-watersheds/catchments:</p> <p>Verde River sub-basin<br/> Salt River sub-basin<br/> Middle Gila sub-basin<br/> Little Colorado River sub-basin<br/> Bill Williams sub-basin</p> <p>A total of ten stressors will be addressed with implementation of this action. The timeframe for completion will be four stressors addressed by year four, two more by year six, two more by year eight, and two more by year ten.</p> <p>The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species through planning using a watershed approach. The AGFD shall apply its Watershed-based Fish Management Process (AGFD 2009) to develop aquatic species management plans for all priority watersheds in the state. The planning process will include consideration for special status species and identify conservation opportunities for incorporation within the planning framework. Special status species will benefit through identification of focal management areas and restoration needs that can be prioritized into multiple land management programs and funding sources in a coordinated approach. For the first priority watershed, planning will begin within the first year and be completed by the third year.</p> |
| Piscivorous riparian or aquatic nesting birds         | <p>Within the one year, the AGFD shall develop information tools to educate anglers on the impacts of fishing debris on riparian or aquatic nesting birds. The AGFD shall continue to support the monofilament recovery bin program by replacing old and providing new bins as needed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

**Table 6. ESA Discretionary Conservation Measures that will be implemented contingent upon funding availability.**

| <b>Species</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Conservation Measure</b>                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Multiple species                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The AGFD shall reintroduce ACS and sensitive aquatic species alongside Focal species as deemed appropriate during planning.                                                                                                                                                                                     |
| Arizona treefrog<br>Huachuca DPS,<br>Northern leopard frog,<br>Northern Mexican<br>garter snake, narrow-<br>headed garter snake,<br>headwater chub,<br>roundtail chub, loach<br>minnow, Chiricahua<br>leopard frog,<br>quitobaquito pupfish,<br>desert pupfish,<br>Sonoran tiger<br>salamander, Gila<br>topminnow, razorback<br>sucker, Apache trout,<br>Southwestern willow<br>flycatcher, Little<br>Colorado spinedace,<br>page springs<br>springsnail, Sonora<br>chub, spikedace, three<br>forks spring snail,<br>yellow-billed cuckoo | The AGFD shall continue to work with partners to implement species recovery plans or other recovery/conservation strategies, including monitoring, nonnative species removal efforts, reestablishment of populations within the historical range, monitoring and repair of barriers, or other tools/approaches. |
| Chiricahua leopard<br>frog, spikedace, loach<br>minnow, Northern<br>leopard frog, narrow-<br>headed garter snake                                                                                                                                                                                                                                                                                                                                                                                                                          | The AGFD shall share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and garter snake populations in the San Francisco River drainage.          |
| Gila chub                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The AGFD shall work with AESO and partners to develop and implement a recovery plan for the Gila chub. As part of that effort, conservation needs for the species relative to nonnative fish species will be identified and included in the plan.                                                               |
| Southwestern willow<br>flycatcher                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | The AGFD shall work with the ASNF to evaluate impacts to physical and biological features of designated critical habitat on the West Fork Little Colorado River from anglers accessing the stocking sites at Greer and Sheeps Crossing.                                                                         |
| Yellow-billed cuckoo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The AGFD shall work with the Coconino, Prescott, and Tonto National Forests to evaluate impacts to physical habitat features along the occupied habitats on the Verde River from anglers accessing the stocking sites at the middle Verde River, Oak Creek, West Clear Creek, and Wet Beaver Creek.             |

| Species                         | Conservation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Little Colorado spinedace       | <p>While implementing the Integrated Fisheries Management Plan for the Little Colorado River (Young et al. 2001) and the East Clear Creek Watershed Recovery Strategy for Little Colorado Spinedace and Other Riparian Species (USDA 1999), in cooperation with other partners, the AGFD shall consider other conservation measures to benefit the species. Such measures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Surveys in the Chevelon Creek watershed from the headwaters to Rock Art Ranch to identify nonnative species distribution and determine suitability of habitats for spinedace reintroductions;</li> <li>• Once suitable habitats are identified, plan and implement renovations and reintroductions of spinedace into the Chevelon Creek watershed;</li> <li>• Remove wild trout from drainages above CC Cragin Reservoir and green sunfish from below the reservoir;</li> <li>• Remove wild brown trout and nonnative warmwater fish species from the mainstem Little Colorado River above Lyman Lake;</li> <li>• Repatriate any spinedace found in Nelson Reservoir to occupied habitat upstream;</li> <li>• Continue to work with partners to replicate populations, fund habitat improvements, and maintain or improve habitat for spinedace on Wildlife Management areas that support spinedace.</li> </ul> |
| New Mexico meadow jumping mouse | The AGFD shall explore opportunities to manage for suitable meadow jumping mouse habitats at other AGFD-owned properties in the White Mountains.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Humpback chub                   | While implementing the Integrated Fisheries Management Plan for the Little Colorado River (Young et al. 2001), the AGFD shall consider information and recommendations identified in Stone et al. (2007), Hilwig et al. (2009) and Valdez and Thomas (2009) regarding the Little Colorado River drainage above Grand Falls as a possible source of nonnative fish species (particularly channel catfish) into occupied humpback chub habitat in the lower Little Colorado River.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### Evaluation & Reporting: Performance Measures and Outcomes

The AGFD will report on progress and implementation of mitigation measures annually over the 10-year period. Reports will be submitted to the WSFR and AESO. The annual report will provide the status of each activity, both new and ongoing, included in the reporting year's annual work plan. Annual Reports will be submitted by September 30 annually. Reporting on CAMP will be in a standalone document, reported separately from other grant documents.

The Annual Report will:

- Identify completion of annual work plan actions and evaluate the outcomes to date
- Identify ongoing actions and estimated completion and outcomes
- Identify remaining measures to be completed and evaluate the timeline and feasibility for completion
- Identify any modification of measures due to unforeseeable/changed circumstances that affect the ability to complete measures
- Identify how any new measures that may replace old measures will offset effects of the proposed action and are commensurate with initial measures that can no longer be implemented due to circumstances outside of WSFR or AGFD control



- Identify expenditures (including amount and source) on implementation of the measures during the reporting year
- Identify total funding to date.

FWS will review the annual report and evaluate progress to date.

### **Sufficient Progress Assessment**

At the end of Year 3, Year 6 and in Year 10, the FWS (AESO and WSFR) will assess progress of CAMP using the following measures:

- CAMP Focal species population responses from reestablishment or securing actions based on criteria in definitions.
- Measurable reduction in stressors to other (non-consultation) special status aquatic and semi-aquatic CAMP species from stressor reduction actions. For example, this would include a measurable reduction or complete elimination of problem nonnative species or a measurable improvement in habitat quality or security.
- Sufficient progress toward completion of other mandatory activities.
- Evaluate whether intended magnitude of the mitigation measures has been achieved for all CAMP species.
- Contribution towards recovery of BCO species in the Action area.

Only if suitable progress is made, as determined by WSFR and AESO, will grant funds be eligible for use in implementing the Statewide Sportfish Stocking Program.

### **Public Involvement**

The public will be notified of Annual CAMP Report availability and reports will be posted on the AGFD website: [www.azgfd.gov](http://www.azgfd.gov) and hard copies will be made available upon request. CAMP progress updates will be provided to the AGFD Commission. AGFD Commission meetings are held monthly and are open to the public. The public may comment or question any wildlife activity or program at any Commission meeting. A schedule of upcoming meetings is posted on the AGFD website. Members of the public can attend in person or view the meeting remotely via web-broadcasting.

### **Anticipated Benefits**

The CAMP is designed to reduce and offset effects from the stocking action and contribute to recovery of consultation species and conservation of other (non-consultation) special status species. Though the CAMP is a 10-year program that will be operated concurrent with the 10-year stocking action, many of the benefits of the CAMP will be long lasting and accrue well beyond the 10-year project period. Beneficial outcomes of measures such as stressor removal, watershed plan development, establishing new populations, and others will continue beyond the 10-year period (e.g., reestablished populations are expected to persist into the foreseeable future).

The following discussion is a summary of the benefits of the actions that will be taken for the CAMP species. These actions are tied back to recovery plans or conservation plans, as appropriate.

*Chiricahua leopard frog*

Chiricahua leopard frog is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. As of 2009, there were 84 sites in Arizona at which Chiricahua leopard frog occur or are likely to occur in the wild, with four additional captive or partially captive refugia sites. Chiricahua leopard frogs also face a myriad of threats including disease, habitat desiccation, and predation from various nonnative species. According to the AESO analysis in the DBCO for the proposed action, stocking at thirteen stocking locations has the potential to affect Chiricahua leopard frogs with varying probability and severity at eight occupied areas (East Fork Black River, Ellison/Lewis Creek, San Francisco River near Reserve, Cienega Creek, Empire Cienega, Scotia Canyon, Peña Blanca, and Tonto Creek). An important concern and potential effect is inadvertent transport of nonnative organisms or disease by stocking or by anglers using live bait. Predation to frogs by stocked sport fish is also a concern. These effects will be reduced and offset by the following measures found in that DBCO and the CAMP in the proposed action. Most of these measures are directly tied to recovery actions identified in the Chiricahua leopard frog recovery plan (USFWS 2007). Where this is the case the specific recovery action is identified after the measure.

5. For warm water sportfish stocking actions at sites where effects to Chiricahua leopard frogs are a concern, the “sensitive areas” HACCP plan will be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan involves the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sportfish. Loads containing unwanted aquatic organisms will be refused and not stocked. Recovery Actions 1.2.10; 1.2.11
6. For coldwater sportfish stocking actions at sites where effects to Chiricahua leopard frogs are a concern and trout or grayling are coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery will be in place to reduce the risk of contamination of the fish to be stocked. Recovery Actions 1.2.10; 1.2.11
7. AGFD will, within three years, convert all rainbow trout stocking from its hatcheries to triploid individuals. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population. Recovery Action 1.2.10
8. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the AGFC for implementation consideration. Recovery Actions 1.2.10.3
9. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species. Recovery Action 1.2.10.3
10. AGFD will review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information

as deemed appropriate to increase angler awareness that such transport and use are harmful. Recovery Action 1.2.10.3; 7.3.

11. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species. Recovery Action 1.2.10.3
12. AGFD commits to provide for three populations of Chiricahua leopard frog either through securing existing but threatened populations or establishment of new conservation populations. Recovery Actions 1.2.9; 1.2.17; 1.3; 3.
13. AGFD will share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and garter snake populations in the San Francisco River drainage.

In particular, measures 1-3 will reduce potential effects of the proposed action; measures 4-7 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to Chiricahua leopard frog from other actions (actions outside of the proposed action); measure 8 will offset effects of the proposed action by directly benefiting Chiricahua leopard frog, and measure 9 will involve data sharing to determine if effects will occur from stocking at one particular site (Luna Lake). The overall result of these measures will be a reduction in risk to Chiricahua leopard frog from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms and diseases, and either an increase of three populations of Chiricahua leopard frog or securing of three existing threatened populations or some combination. These would represent a substantial contribution to the conservation of this species and implementation of the recovery plan.

Additional actions are also included in the CAMP contained in the proposed action that are not intended as mitigation to this species but still may benefit this species. These additional efforts include removal of threats in Verde River, Salt River, LCR, and Gila River watersheds, and watershed planning in priority watersheds (Recovery Action 1.2.1). In addition, several non-mandatory measures including a general measure of implementing the recovery plan for the Chiricahua leopard frog. The non-mandatory measures will be implemented if funds are available.

#### Loach minnow

Loach minnow is a CAMP focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the DBCO and CAMP contained in the proposed action. Loach minnow currently occupy 8 general locations in NM and AZ: Eagle Creek, North Fork East Fork Black River, White River including East Fork and North Fork, Aravaipa Creek, San Francisco and Blue rivers, Upper Gila River and tributaries East, Middle, and West Forks, and Tularosa Rivers and tributaries Negrito and Whitewater creeks. At these locations loach minnow range from abundant (Aravaipa Creek and Blue River) to possibly extirpated (Black River and Eagle Creek) and face a variety of threats. In recent years (2007-current), loach minnow have been stocked into 4 additional locations: Fossil Creek, Bonita Creek, Hot Springs Canyon, and Red Field Canyon.

Loach minnow have been consistently more abundant in annual surveys at Hot Springs Canyon and young-of-year fish have been detected so they may be in the process of establishing a population (Robinson et al. 2011) but the status of the other stocking efforts is not yet conclusive (i.e. it is not know if they have or will establish populations). According to the AESO analysis in the DBCO for the proposed action, stocking at thirteen stocking locations has the potential to affect loach minnow and loach minnow critical habitat in two areas (Black River and San Francisco River) and the potential to affect critical habitat in the Verde River and tributaries. The probability and severity of the effects vary. These effects will be reduced and offset by the following measures found in that Draft DBCO and the CAMP in the proposed action. Most of these measures are directly tied to recovery actions identified in the loach minnow recovery plan (USFWS 1991a). Where this is the case the specific recovery action is identified after the measure.

14. In coordination with AESO, ASNF, and USBR, AGFD will commit to provide for two loach minnow populations either through securing existing but threatened populations or establishment of new conservation populations. These efforts are over and above those included in the USBR funded Gila River Basin Native Fishes Conservation Program for the loach minnow. Recovery Actions 1 & 6
15. AGFD will, within three years, convert all rainbow trout stocking from its hatcheries to triploid individuals. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population. Recovery Action 1.7
16. In the event of insufficient Apache trout to meet annual recreational stocking demands, the East Fork Black River will be a first priority for stocked Apache trout after the recreational stocking sites that are associated with a recovery population (West Fork Black River, West Fork Little Colorado River at Sheeps Crossing, and Lee Valley Lake). Any rainbow trout that are stocked into the East Fork Black River will be sterile triploids to avoid any augmentation to the reproducing population of rainbow trout in the East Fork Black River. Recovery Action 1.7
17. If a spill from Big Lake or Crescent Lake is anticipated, AGFD will place a fish weir to capture fish and prevent downstream movement. If the weir is not installed prior to a spill, a survey for trout species in the occupied habitat of the loach minnow will be completed within that spring/summer season immediately following the spill. All nonnative fish species encountered during that survey will be removed. Recovery Action 1.7
18. In coordination with partners, AGFD will develop and implement a standard survey schedule and protocol to evaluate the fish community with emphasis on stocked trout presence in the loach minnow occupied areas of the East Fork Black River drainage. Recovery Action 1.7 & 2
19. AGFD will share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and garter snake populations in the San Francisco River drainage. Recovery Action 1.7
20. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These

recommendations will be presented to the Arizona Game and Fish Commission for implementation consideration. Recovery Action 1.7

21. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species. Recovery Action 1.7 & 9
22. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such species. Recovery Action 1.7 & 9

In particular, measures 2-4 will reduce potential effects of the proposed action; measures 7-9 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to loach minnow from other actions (actions outside of the proposed action); measure 1 will offset effects of the proposed action by directly benefiting loach minnow, and measure 5-6 will involve monitoring and data sharing to determine if effects will occur at two sites (San Francisco River via stocking at Luna Lake and Black River). The overall result of these measures will be a reduction in risk to loach minnow and critical habitat from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms, and either an increase of two populations of loach minnow or securing of two existing threatened populations or some combination. These outcomes would represent a substantial contribution to the conservation of this species and implementation of the recovery plan.

Additional actions are also included in the CAMP contained in the proposed action that are not intended as mitigation to this species but still may benefit this species. These additional efforts include removal of threats in Verde River, Salt River, and Gila River watersheds (Recovery Actions 6.2.4; 6.2.5; 1.6; 1.10; 1.11), watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing the recovery plan for loach minnow. The non-mandatory measures will be implemented if funds are available.

#### Headwater chub

Headwater chub is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. Headwater chub currently occupy 23 locations in Arizona and New Mexico and the status of the populations range from unknown to unstable and threatened to stable and secure. Headwater chub also face a myriad of threats including habitat loss and predation by or competition with various nonnative species. According to the AESO analysis in the DBCO for the proposed action, stocking at five stocking locations has the potential to affect headwater chub with varying probability and severity at nine occupied areas (East Verde River, Webber Creek, Pine Creek, The Gorge, Fossil Creek, Tonto Creek, Haigler Creek, Marsh Creek, Gordon Creek, and Tonto Creek). These effects will be reduced and offset by the following measures found in that DBCO and the CAMP contained in the proposed action. Since the headwater chub is not listed it does not have a recovery plan. However, most of these measures are directly tied to the *Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little*

*Colorado River Sucker, Bluehead Sucker, and Zuni Bluehead Sucker* (AGFD 2006). Where this is the case the specific conservation action is identified after the measure.

23. AGFD commits to provide for three populations of headwater chub either through securing existing but threatened populations or establishment of new conservation populations. Conservation Actions 4.6; 4.8; 3
24. AGFD will, within three years, convert all rainbow trout stocking from its hatcheries to triploid individuals. While sterility of triploid rainbow trout is not absolute, this conversion will significantly reduce the opportunity for stocked rainbow trout to contribute to maintenance of any wild population. Conservation Action 3.2
25. Headwater chub habitats in the East Verde River and Tonto Creek are priority areas for use of triploid rainbow trout to avoid augmentations to existing wild populations. Conservation Action 3.2
26. AGFD will implement actions to increase angler awareness of headwater chub and inform them that at the East Verde River and Haigler Creek stocking sites it is not a legal sportfish.
27. In order to obtain information needed to implement conservation actions, AGFD will undertake an assessment of headwater chub populations in the East Verde River, Tonto Creek, and the Haigler Creek drainage to determine population structure and extent, nonnative species present as stressors, sites for potential reestablishment, and identification of specific research needs. This assessment will tier off the Arizona Statewide Conservation Agreement and Strategy (AGFD 2006) for headwater chub and five other native fish species, as that document contains considerable information on the conservation needs and a strategy to address those needs. The assessment will serve as a guidance document for implementing conservation actions for the headwater chub. Conservation Actions 5.1-5.4
28. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species. Conservation Action 1.9

In particular, measure 2-3 will reduce potential effects of the proposed action; measures 4 & 6 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to headwater chub from other actions (actions outside of the proposed action); measure 1 will offset effects of the proposed action by directly benefiting headwater chub, and measure 5 will involve monitoring to help determine the status of the species and identify conservation opportunities which is necessary to implement measure 1 and other future conservation actions. The overall result of these measures will be a reduction in risk to headwater chub from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms, and either an increase of three populations of headwater chub or securing of three existing threatened populations or some combination. In addition, the required monitoring will allow management agencies to better assess the status of headwater chub, identify the most relevant threats, and ultimately identify conservation opportunities which are all needed to advance conservation of this species. These measures would represent a substantial contribution to the conservation of this species and

implementation of the *Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little Colorado River Sucker, Bluehead Sucker, and Zuni Bluehead Sucker*.

Addition actions are also included in the CAMP contained in the proposed action that are not intended as mitigation to this species but still may benefit this species. These additional efforts include removal of threats in Verde River and Salt River watersheds (Conservation Actions 3.1; 3.2; 3.9), watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing the *Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little Colorado River Sucker, Bluehead Sucker, and Zuni Bluehead Sucker*. The non-mandatory measures will be implemented if funds are available.

#### Roundtail chub

Roundtail chub is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. Roundtail chub currently occupy 31 streams in Arizona and New Mexico and the status of the stream populations range from unstable and threatened to unknown to stable and secure. Roundtail chub also face a myriad of threats including habitat loss and predation by or competition with various nonnative species. According to the AESO analysis in the DBCO for the proposed action, stocking at 36 stocking sites and the Phoenix urban stocking locations has the potential to affect roundtail chub with varying probability and potential severity. The analysis for roundtail chub is complex and concludes that 18 occupied areas may be affected. The AESO analysis also concludes that stocking in the Phoenix urban lakes and Tempe Town Lake will not significantly affect the roundtail chub. In addition, at 16 of the stocking sites and 6 of the roundtail chub areas being affected only less predacious species will be stocked (rainbow trout, grayling, Apache trout, bluegill, and redear sunfish). The remaining 19 stocking sites and 12 occupied areas involve stocking both more and less predacious species into areas with varying potential for stocked species to escape and move into roundtail chub habitat. These effects will be reduced and offset by the following measures found in that DBCO and the CAMP contained in the proposed action. Roundtail chub is not listed it does not have a recovery plan; however, most of these measures are directly tied to the *Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little Colorado River Sucker, Bluehead Sucker, and Zuni Bluehead Sucker* (AGFD 2006). Where this is the case the specific conservation action is identified after the measure.

29. AGFD commits to provide for three roundtail chub populations either through securing existing but threatened populations or establishment of new conservation populations. Conservation Actions 4.6; 4.8; 3
30. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
31. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the AGFC for implementation consideration. Conservation Action 3.2

32. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species. Conservation Action 3.2
33. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.
34. In order to obtain information needed to implement conservation actions, AGFD will undertake an assessment of roundtail chub populations to determine population structure and extent; nonnative species present as stressors, sites for potential reestablishment, and identification of specific research needs. These efforts will be structured to focus on areas across the range with the greatest potential for conservation benefits. The number and extent of such conservation actions will be determined through the annual work plan for the conservation program. Conservation Actions 5.3-5.4

In particular, measure 2 will reduce potential effects of the proposed action; measures 3-5 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to roundtail chub from other actions (actions outside the proposed action); measure 1 will offset effects of the proposed action by directly benefiting roundtail chub, and measure 6 will involve compellation of existing monitoring information and data to help determine the status of the species and identify conservation opportunities. The overall result of these measures will be a reduction in risk to roundtail chub from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms, and either an increase of three populations of roundtail chub or securing of three existing threatened populations or some combination. In addition, the required population assessments will allow management agencies to better assess the status of roundtail chub, identify the most relevant threats, and ultimately identify conservation opportunities which are all needed to advance conservation of this species. These measures would represent a substantial contribution to the conservation of this species and implementation of the *Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little Colorado River Sucker, Bluehead Sucker, and Zuni Bluehead Sucker*.

Addition actions are also included in the CAMP contained in the proposed action that are not intended as mitigation to this species but still may benefit this species. These additional efforts include removal of threats in Bill Williams, Little Colorado River, Verde River, Gila River, and Salt River watersheds (Conservation Actions 3.1; 3.2; 3.9), watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing the *Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little Colorado River Sucker, Bluehead Sucker, and Zuni Bluehead Sucker*. The non-mandatory measures will be implemented if funds are available.

#### Narrow-headed garter snake

Narrow-headed garter snake is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. Narrow-



headed garter snake currently occupy at least 19 areas in Arizona and New Mexico. The narrow-headed garter snake faces a myriad of threats including habitat loss and various nonnative species. According to the AESO analysis in the DBCO for the proposed action, stocking at 20 stocking sites has the potential to affect narrow-headed garter snake. Effects from five of the stocking sites are considered limited and effects from an additional site (Luna Lake) is considered not likely; however, a mitigation measure is in place to determine if effects will occur. The remaining 14 sites have varying probability to affect narrow-headed garter snake with varying severity at 4 narrow-head garter snake occupied areas (Black River, Canyon Creek, Middle Verde, and Oak Creek). In particular the main potential effects from the proposed action are anglers directly killing snakes (which is illegal but still could happen) and either spreading non-target organisms or stocked fish themselves which could affect the native fish prey base of the narrow-headed garter snake. These effects will be reduced and offset by the following measures found in that DBCO and the CAMP contained in the proposed action. Since the narrow-headed garter snake is not listed it does not have a recovery plan. However, these measures are directly tied to actions identified in the draft Arizona State Wildlife Action Plan (AGFD 2011).

35. AGFD commits to provide for two NH garter snake populations either through securing existing but threatened populations or establishment of new conservation populations. In providing for two NH garter snake populations either through securing existing but threatened populations or establishment of new conservation populations, AGFD recognizes that a source for individuals to reestablish conservation populations is needed, as is information on propagation and release options. The Garter snake Working Group has initiated work in these arenas, and AGFD will contribute to these efforts during the 10-year program. Once sufficient information on potential release sites, release progeny, and release methods is obtained, AGFD will initiate the reestablishment program.
36. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
37. AGFD will develop outreach material on garter snakes to attempt to reduce the deliberate killing or injuring of garter snakes by the public. Materials developed for this program will be posted at stocking sites that contain populations of garter snakes.
38. AGFD will ensure that renovated streams occupied by NH garter snakes will be quickly restocked with appropriate native fish species that can provide prey for NH garter snakes so as to not put stress on any NH garter snake population through elimination of its forage base. This will be done as part of all native fish reintroduction efforts in Arizona near garter snake occupied areas.
39. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the Arizona Game and Fish Commission for implementation consideration.
40. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species.
41. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing

the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

42. AGFD will develop and implement a public education program on garter snakes to attempt to reduce the deliberate killing or injuring of garter snakes by the public. Materials developed for this program will be posted at stocking sites (in cooperation with land management agencies) that contain populations of garter snakes.
43. AGFD will work with New Mexico Department of Game and Fish to examine the role of escaped rainbow trout from Luna Lake in supporting wild rainbow trout populations in the San Francisco River, the Tularosa River, and Negrito Creek, both tributaries to the San Francisco River supporting NH garter snake.

In particular, measure 2 will reduce potential effects of the proposed action; measures 5-7 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to narrow-headed garter snakes from other actions (actions outside the proposed action); measures 3 & 8 will offset effects of the proposed action by reducing the risk posed to narrow-headed garter snakes by illegal killing; measure 1 & 4 will offset effects of the proposed action by directly benefitting narrow-headed garter snakes, and measure 9 will involve data sharing to determine effects from one stocking site (Luna Lake). The overall result of these measures will be a reduction in risk to narrow-headed garter snake from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms, a reduction in the risk from illegal deliberate killing by people, and either an increase of two populations of narrow-headed garter snake or securing two existing threatened populations or some combination. These measures would represent a substantial contribution to the conservation of this species.

Additional actions are also included in the CAMP contained in the proposed action that are not intended as mitigation for this species but still may benefit this species. These additional efforts include removal of threats in Verde River, Salt River, and Gila River watersheds, watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing conservation for the species. The non-mandatory measures will be implemented if funds are available.

#### New Mexico meadow jumping mouse

New Mexico meadow jumping mouse is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. The New Mexico meadow jumping mouse currently occupies at least 23 areas in Arizona and New Mexico. The main threat for New Mexico meadow jumping mouse is habitat destruction including destruction and degradation of riparian vegetation. According to the AESO analysis in the DBCO, stocking at six stocking locations has the potential to affect New Mexico meadow jumping mouse at six occupied areas with varying probability and severity. The potential effect of stocking is increased angler use of riparian areas which could lead to habitat degradation. These effects will be reduced and offset by the following measures found in that DBCO and the CAMP contained in the proposed action. Since the New Mexico meadow jumping mouse is not listed it does not have a recovery plan.

44. AGFD will provide protection from human access impacts, and if needed, enhancement actions for meadow jumping mouse habitats on AGFD owned lands on the West Fork Black River.
45. AGFD will coordinate with the Apache-Sitgreaves National Forest on evaluations of effects to meadow jumping mouse habitat along the East and West Forks of the Little Colorado River.

In particular, the measures will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the effects to New Mexico meadow jumping mouse from other actions (actions outside the proposed action). These would represent site-specific mitigation and an overall contribution to the conservation of this species.

An additional action is also included in the CAMP contained in the proposed action that is not intended as mitigation for this species but still may benefit this species. This action is a non-mandatory action of exploring opportunities to manage for suitable meadow jumping mouse habitats at other AGFD-owned properties in the White Mountains.

#### Northern leopard frog

Northern leopard frog is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. The western populations of northern leopard frog are found in Arizona, California, Colorado, Idaho, Iowa, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, Washington, Wisconsin, and Wyoming. Northern leopard frogs have declined throughout their range and face a myriad of threats including disease, habitat desiccation and destruction, and predation from various nonnative species. According to the AESO analysis in the DBCO, stocking at 22 stocking locations has the potential to affect northern leopard frogs with varying probability and severity. Of those 22 sites, 11 could affect frogs in currently known occupied areas and the other 11 could affect frogs in historically occupied areas if those areas are still occupied. An important concern and potential effect is inadvertent transport of nonnative organisms or disease by stocking or by anglers using live bait. Predation of frogs by stocked sport fish is also a concern. These effects will be reduced and offset by the following measures found in that DBCO and the CAMP contained in the proposed action. Since the northern leopard frog is not listed it does not have a recovery plan.

46. AGFD commits to provide for two northern leopard frog populations either through securing existing but threatened populations or establishment of new conservation populations. Replication of the Lyman Lake population into another portion of the eastern Little Colorado River drainage (the Forks area of the Little Colorado River is a potential area) is included in this commitment.
47. For warmwater sport fish stocking actions at sites where effects to northern leopard frogs are a concern, the “sensitive areas” HACCP plan will be followed by AGFD personnel receiving the fish from the vendor. This “sensitive areas” plan involves the double-sorting and examination of all fish in the load to reduce the risk of introduction of unwanted aquatic organisms with the sport fish. Loads containing unwanted aquatic organisms will be refused and not stocked.

48. For fish coming from AGFD hatcheries, the HACCP plan for disease and parasite control at the hatchery will be in place to reduce the risk of contamination of the fish to be stocked.
49. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
50. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) regulation assessment and risk analysis to develop recommendations to amend live bait regulations. These recommendations will be presented to the AGFC for implementation consideration.
51. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about the regulations regarding capture, use, and proper discard of live bait species.
52. AGFD will share information with, and periodically solicit available information from, the New Mexico Department of Game and Fish to assess if stocking at Luna Lake potentially may have impacts to native fish, leopard frog, and garter snake populations in the San Francisco River drainage.

In particular, measures 2-4 will reduce potential effects of the proposed action; measures 5 & 6 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to northern leopard frog from other actions (actions outside of the proposed action); measure 1 will offset effects of the proposed action by directly benefitting northern leopard frog, and measure 7 will involve data sharing to determine if effects will occur from stocking at one particular site (Luna Lake). The overall result of these measures will be a reduction in risk to northern leopard frog from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms and diseases, and either an increase of three populations of northern leopard frog or securing of three existing threatened populations or some combination. These would represent a substantial contribution to the conservation of this species.

Additional actions are also included in the CAMP contained in the proposed action that are not intended as mitigation to this species but still may benefit this species. These additional efforts include removal of threats in Verde River, Salt River, LCR, and Gila River watersheds, watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing the conservation measures for this species. The non-mandatory measures will be implemented if funds are available.

#### Northern Mexican garter snake

Northern Mexican garter snake is a CAMP Focal species for conservation in the proposed action and as such, will receive benefits from both general and specific actions to address the effects of sportfish stocking on the species as part of the CAMP contained in the proposed action. The northern Mexican garter snake currently occupies at least eight areas in Arizona and status at ten additional sites is unknown. Northern Mexican garter snakes face a myriad of threats including habitat loss, food source loss and replacement with inedible or less suitable nonnative species, and predation by and competition with various nonnative species. According to the AESO analysis in the DBCO for the proposed action, stocking at 32 stocking locations has the potential to affect northern Mexican garter snake. Effects from 23 of those 32 stocking sites are considered

limited. The remaining nine sites have varying probabilities of affect Northern Mexican garter snake with varying severity at seven areas (Middle Verde River, Oak Creek, Arivaca Cienega, Cienega Creek, Scotia Canyon, San Rafael Valley, and Sonoita Creek). These effects will be reduced and offset by the following measures found in the DBCO and the CAMP contained in the proposed action. The northern Mexican garter snake is not listed and does not have a recovery plan. However, these measures are directly tied to actions identified in the draft Arizona State Wildlife Action Plan (AGFD 2011).and address general threats identified in the 12-month finding for northern Mexican garter snake (USFWS 2008).

53. AGFD commits to provide for two NM garter snake populations either through securing existing but threatened populations or establishment of new conservation populations. AGFD recognizes that a source for individuals to reestablish conservation populations is needed to accomplish this measure, as is information on propagation and release options. The Gartersnake Working Group has initiated work in these arenas, and AGFD will contribute to these efforts during the 10-year program. Once sufficient information on potential release sites, release progeny, and release methods is obtained, AGFD will initiate the reestablishment program.
54. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
55. AGFD will develop outreach material on garter snakes to attempt to reduce the deliberate killing or injuring of garter snakes by the public. Materials developed for this program will be posted at stocking sites (in cooperation with land management agencies) that contain populations of garter snakes.
56. AGFD will ensure that renovated streams occupied by NM garter snakes will be quickly restocked with appropriate native fish species and native frog species that can provide prey for NM garter snakes so as to not put stress on any NM garter snake population through elimination of its forage base. This will be done as part of all native fish reintroduction efforts in Arizona near garter snake occupied areas.
57. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the AGFC for implementation consideration.
58. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species.
59. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

In particular, measure 2 will reduce potential effects of the proposed action; measures 5-7 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to northern Mexican garter snake from other actions (actions outside the proposed action); measure 3 will offset effects of the proposed action by reducing the risk posed to narrow-headed garter snakes by illegal killing; measure 1 & 4 will offset effects of the proposed action by directly benefitting northern Mexican garter snake. The overall result of these

measures will be a reduction in risk to northern Mexican garter snake from the proposed action, an overall range-wide reduction in the risk of spread of potentially destructive non-native organisms, a reduction in the risk from illegal deliberate killing by people, and either an increase of two populations of northern Mexican garter snake or securing of two existing threatened populations or some combination. These measures would represent a substantial contribution to the conservation of this species.

Additional actions are also included in the CAMP contained in the proposed action that are not intended as mitigation for this species but still may benefit this species. These additional efforts include removal of threats in Verde River, Salt River, and Gila River watersheds, watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing conservation for northern Mexican garter snake. The non-mandatory measures will be implemented if funds are available.

*Other consultation species with likely to adversely affect calls*

The following species were determined by the AESO analysis in the DBCO for the proposed action to have potential negative effects but were not identified in that analysis as a focal species for the conservation measures due to a lesser level of effects: Apache trout, Bonytail chub, Gila chub, Gila topminnow, Gila trout, humpback chub, Little Colorado spinedace, Mount Graham red squirrel, Razorback sucker, Sonoran tiger salamander, spikedace, and Southwestern willow flycatcher. However, several mitigation and conservation measures were identified in the DBCO and CAMP contained in the proposed action that will reduce and offset effects to some of these species from the proposed action. Many of these measures are directly tied to recovery actions in the species recovery plans (USFWS 2009, USFWS 2002, USFWS 1998a, USFWS 1998b, USFWS 1992, USFWS 1990b, USFWS 1990c).

*General measures that would benefit all aquatic species on this list*

60. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
61. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the AGFC for implementation consideration.
62. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species.
63. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

*Apache trout*

64. The AGFD shall continue to work with partners to evaluate barrier conditions on the three streams, survey for nonnative fish in recovery streams, and repair barriers as part of the proposed action. Recovery Actions 1.11-1.12

*Gila chub*

65. In two years during the 10-year period, the AGFD shall survey the occupied Gila chub habitat on public lands in Spring Creek above the barrier when habitat conditions are conducive to rainbow trout persistence. If any stocked rainbow trout are found, these shall be documented and removed from the stream and an additional survey to locate stocked rainbow trout shall be implemented in the following year.

*Spikedace*

66. The AGFD shall continue monitoring of the Upper Verde River to evaluate native and nonnative fish populations. Any individuals of the stocked sport fish species captured during such monitoring shall be removed from the river and reported annually. Recovery Action 2.5

*Sonoran tiger salamander*

67. The AGFD shall work with Federal, state, and private partners to identify and implement projects that reduce the risk of hybridization between Sonoran tiger salamanders and nonnative salamanders. Recovery Action 3.1-3.2
68. The AGFD shall review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are harmful. Recovery Actions 7.1-7.2

*Mount Graham red squirrel*

69. The AGFD shall coordinate with the Coronado National Forest on traffic management that can reduce the risk of mortality to Mount Graham red squirrels from vehicles accessing Riggs Flat Lake as part of continuing implementation of the Mount Graham Red Squirrel Recovery Plan. Recovery Action 1.2.7

*Little Colorado spinedace*

70. The stocking restrictions and implementing actions from the 1995 (FWS 1995) and 2001 (FWS 2001) incidental take statements for CC Cragin Reservoir, Knoll Lake, and Nelson Reservoir, except for modified creel survey requirements, are part of the Proposed Action for this consultation and shall be implemented over the next 10 years as described in those documents. Creel surveys shall occur no less than once every 10 years. Recovery Actions 1.5.1; 3.1.2; 3.1.3

*Bonytail chub and razorback sucker*

71. Prior to any stocking into La Paz County Park Lagoon, signs similar to those used on Lake Havasu will be posted at the lagoon describing bonytail to anglers and informing them of what to do should they catch one. These signs will remain in place as long as the barrier net is in place at the lagoon. Bonytail chub Recovery Action 4.41.
72. A barrier net will be placed at the La Paz County Park Lagoon immediately prior to the stocking event and remain in place for seven days after the stocking event. Razorback sucker Recovery Action 1.3.1 and Bonytail chub Recovery Action 1.12

In particular, measure 1 will reduce potential effects of the proposed action; and measures 2-4 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to many of these species from other actions (actions outside the proposed action).

Measure 5 & 6 consists of monitoring at three Apache trout and one Gila chub populations to determine if effects could occur. This measure will also provide direct benefit to Apache trout and Gila chub by reducing the risk of barrier failure and total loss of a population should a barrier fail. Since this risk is mostly associated with the existing populations of nonnative species near these sites, this benefit would be offsetting potential effects from the proposed action on these species by reducing risks.

Measure 7 consists of monitoring at a spikedace population to determine if effects from the proposed action occur and to reduce those effects if they were to occur by removing the stocked fish.

Measure 8 would offset effects of the proposed action by directly benefiting Sonoran tiger salamander through reduction of genetic threats from nonnative salamanders. Measure 9 would both reduce potential effects of the proposed action and offset effects by also reducing the risk posed to Sonoran tiger salamander from other actions (actions outside the proposed action).

Measure 10 would reduce the effects from the proposed action on Mount Graham red squirrel.

Measure 11 includes several measures that would monitor at several stocking locations to determine if effects occur to Little Colorado River spinedace. In addition, several measures included would implement management and stocking practices that would reduce the risk of stocked fish escapement from several stocking locations with nearby Little Colorado River spinedace populations.

Measures 12 & 13 would reduce the effects of the proposed action on razorback sucker and bonytail chub.

Overall, these measures would represent reductions in the effects to several additional consultation species for which the AESO identified as needing mitigation in the DBCO for the proposed action. In addition, some of these measures would also contribute to the general conservation of many of these species.

Additional actions are also included in the CAMP in the proposed action that are not intended to as mitigation to these species but still may benefit these species. These additional efforts include removal of threats in five watersheds, watershed planning in priority watersheds, and several non-mandatory measures including a general measure of implementing recovery plans for these species or other conservation strategies for the species without recovery plans. The non-mandatory measures will be implemented if funds are available.



Non-consultation fish species (longfin dace, speckled dace, desert sucker, Sonoran sucker, LCR sucker, and bluehead sucker).

The proposed action has the potential to affect longfin dace, speckled dace, desert sucker, Sonoran sucker, LCR sucker, and bluehead sucker. The potential effects are summarized in the following table:

**Summary of Potential Effects to Non-Consultation Fish and One Amphibian**

| <b>Species</b>         | <b>Low Potential Effects (# of stocking sites)</b> | <b>Moderate Potential Effects (# of stocking sites)</b> | <b>High Potential Effects (# of stocking sites)</b> |
|------------------------|----------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------|
| longfin dace           |                                                    |                                                         |                                                     |
| speckled dace          |                                                    |                                                         |                                                     |
| Sonora sucker          |                                                    |                                                         |                                                     |
| desert sucker          |                                                    |                                                         |                                                     |
| Little Colorado sucker |                                                    |                                                         |                                                     |
| bluehead sucker        |                                                    |                                                         |                                                     |
| lowland leopard frog   |                                                    |                                                         |                                                     |

Definitions from Draft EA

*High*—Stocking locations predicted to have exposure that was highly probable and the potential biological impacts to non-consultation special status species would be expected to be substantial. Actions at these stocking sites could result in long-term population declines of other special status species in a localized area or at a watershed level.

*Moderate*—Stocking locations predicted to have exposure that was more limited in probability or to have exposure that was highly probable but in conjunction with potential biological impacts to other special status species that were not substantial. Actions at these sites, when analyzed at a site-specific level, could impact individuals of other special status species or even cause temporary and/or localized population declines but would not likely result in long-term population declines at a watershed level. However, individual sites, when considered together with other stocking sites in the same watershed that had “Moderate” outcomes, could have more substantial impacts and result in long-term population declines of other special status species in a localized area or at a watershed level.

*Low*—Stocking locations predicted to have exposure that was limited in probability or probable exposure but in conjunction with limited potential biological impacts to other special status species. Actions at these sites could impact individuals of other special status species but would not likely result in population declines of other special status species even when considered with other stocking sites within the same watershed that had “Low” outcomes.

These effects will be reduced and offset by the following measures found in the CAMP contained in the proposed action. Since these species are not listed they do not have a recovery plans. However, these measures are directly tied to actions identified in the draft Arizona State Wildlife Action Plan (AGFD 2011).

1. The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species (i.e. non-consultation species) through the removal of key stressors. The AGFD shall address two stressors impacting these species and associated aquatic communities within each of the following sub-watersheds/catchments:
  - a. Verde River sub-basin
  - b. Salt River sub-basin
  - c. Middle Gila sub-basin
  - d. Little Colorado River sub-basin
  - e. Bill Williams sub-basin
2. The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species (i.e. non-consultation species) through planning using a watershed approach. The AGFD shall apply the Watershed-based Fish Management Process (AGFD 2009) to develop aquatic species management plans for all priority watersheds in the state. The planning process will include consideration for special status species and identify conservation opportunities for incorporation within the planning framework. Special status species will benefit through identification of focal management areas and restoration needs that can be prioritized into multiple land management programs and funding sources in a coordinated approach.
3. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
4. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the AGFC for implementation consideration.
5. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species.
6. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

In particular, measure 3 will reduce potential effects of the proposed action; measures 4-6 will both reduce potential effects of the proposed action and offset effects of the proposed action by also reducing the risk posed to these species from other actions (actions outside the proposed action); and measure 1 & 2 will offset effects of the proposed action by reducing threats from other actions (actions outside the proposed action) and threats from the existing baseline; and developing a plan that will identify focal management areas and restoration needs for native species that can be prioritized into multiple land management programs and funding sources in a coordinated approach. These measures would represent a substantial contribution to the conservation of these species.

Additional actions are also included in the CAMP in the proposed action that are not intended to mitigate and offset impacts to these species but still may benefit this species. These additional

efforts include reestablishment of some of these species along with focal species in a community-based approach.

Lowland leopard frog

Lowland leopard frog are now found mainly in Arizona but historically were also found in SE California, SW New Mexico, and N Sonora (Sredl 1997). The status of the species in Sonora is poorly known, it is believed to be extirpated from California, and the last detection in New Mexico (1 individual) was in 2000 (Sredl 2005, Sredl 1997). Sredl (1997) detected lowland leopard frog in Arizona at 43 of 115 surveyed historical locations and 61 new sites for a total of 104 known occupied locations as of the mid 1990's (140 historical sites were not surveyed). During this survey lowland leopard frog were found in the following watersheds: Colorado River, Bill Williams River, Upper Gila River, San Pedro River, Santa Cruz River, Salt River, Aqua Fria River, Verde River, and Rio Concepcion.

Stocking at 36 stocking sites has the potential to affect lowland leopard frogs, with 27 of those sites having a low potential effect (will only affect individuals or affect populations on a short-term basis/see definition). Of the remaining sites, 4 will have a high potential effect and 5 will have a moderate potential effect (see above definitions). The high potential effect stocking locations are in the Bill Williams (2) and the Verde River (2) watersheds. The moderate effect stocking locations are in the Verde River (2), Santa Cruz (1), and Salt River (2).

Based on the site level analysis in this EA, none of the high effects stocking actions would result in watershed-level declines of lowland leopard frogs because in both watersheds where high effects occur lowland leopard frog have additional available habitat and are known from several locations besides the locations being impacted by the stocking action. However, at these stocking locations stocked fish could have impacts to local populations.

These effects will be reduced and offset by the following measures found in the CAMP contained in the proposed action. Since these species are not listed they do not have a recovery plans. However, these measures are directly tied to actions identified in the draft Arizona State Wildlife Action Plan (AGFD 2011).

73. The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species (i.e. non-consultation species) through the removal of key stressors. The AGFD shall address two stressors impacting these species and associated aquatic communities within each of the following sub-watersheds/catchments:
  - a. Verde River sub-basin
  - b. Salt River sub-basin
  - c. Middle Gila sub-basin (including Santa Cruz watershed)
  - d. Little Colorado River sub-basin
  - e. Bill Williams sub-basin
74. The AGFD shall contribute to the conservation of other special status aquatic and semi-aquatic species (i.e. non-consultation species) through planning using a watershed approach. The AGFD shall apply the its Watershed-based Fish Management Process (AGFD 2009) to develop aquatic species management plans for all priority watersheds in the state. The planning process will include consideration for special status species and

identify conservation opportunities for incorporation within the planning framework. Special status species will benefit through identification of focal management areas and restoration needs that can be prioritized into multiple land management programs and funding sources in a coordinated approach.

75. AGFD will, within three years, convert to triploid rainbow trout for all AGFD hatchery stockings except in closed systems and urban lakes.
76. AGFD will conduct a statewide live bait (bait fish and tiger salamanders) use assessment and risk analysis to develop recommendations to amend live bait management. These recommendations will be presented to the AGFC for implementation consideration.
77. AGFD will review and update existing outreach programs addressing use of live bait to ensure they are adequately informing the public about capture, use, and proper discard of live bait species.
78. AGFD will review and update existing outreach programs on the risks to native aquatic species from the transport of nonnative aquatic species (sportfish, baitfish, other fish species, amphibians, invertebrates, and plants) to ensure they are adequately informing the public of the harmful nature of such actions, and means they can take to reduce or prevent inadvertent transport of such nonnative species.

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**Final Proposed Action:** Stocking sites, species, numbers, season and size of fish proposed for stocking for the period covered by this consultation. Species or sites in green are a new species from previous consultations/approved actions. Proposed species unless otherwise noted, are assumed to be present in the water body. Cells shaded light blue indicate stocking would occur in the event complete or partial loss of the fishery, and in most cases numbers will be based on identified stocking protocols, in some cases numbers and seasons are identified; the reader must refer to stocking numbers identified in either the Statewide Sport Fish Stocking Protocol or the Urban Fishing Startup and Augmentation Stocking Guidelines.

| Stocking Sub-Program | Watershed             | Complexes            | Stocking Sites | Species from documents | total number of fish planned to be stocked | Season                                       | Size                                 | Comments |
|----------------------|-----------------------|----------------------|----------------|------------------------|--------------------------------------------|----------------------------------------------|--------------------------------------|----------|
| Statewide            | <b>Colorado River</b> | Havasu Creek Complex | Cataract Lake  | ONMY                   | 35,000                                     | March-November multiple times annually       | sub-catchable, catchable             |          |
| Statewide            |                       |                      | Cataract Lake  | <sup>1</sup> SATR      | 20,000                                     | fall multiple times annually                 | sub-catchable, catchable             |          |
| Statewide            |                       |                      | Cataract Lake  | ICPU                   | 1,500                                      | spring, summer                               | catchable                            |          |
| Statewide            |                       |                      | Cataract Lake  | ICPU                   | sport fish stocking protocol               | anytime augment/catastrophic events          | fingerling, sub-catchable            |          |
| Statewide            |                       |                      | Cataract Lake  | MISA                   | sport fish stocking protocol               | anytime augment/catastrophic events          | fingerling, sub-catchable, catchable |          |
| Statewide            |                       |                      | Cataract Lake  | <sup>1</sup> LEMA      | sport fish stocking protocol               | anytime augment/catastrophic events          | fingerling, sub-catchable            |          |
| Statewide            |                       |                      | Cataract Lake  | <sup>1</sup> LEMI      | sport fish stocking protocol               | anytime augment/catastrophic events          | fingerling, sub-catchable            |          |
| Statewide            |                       |                      | City Reservoir | ONMY                   | 13,000                                     | spring, summer, fall multiple times annually | sub-catchable, catchable             |          |
| Statewide            |                       |                      | City Reservoir | <sup>1</sup> SATR      | 7,000                                      | fall multiple times annually                 | sub-catchable, catchable             |          |
| Statewide            |                       |                      | City Reservoir | ICPU                   | 3,900                                      | spring, summer multiple times annually       | catchable                            |          |
| Statewide            |                       |                      | City Reservoir | <sup>2</sup> MISA      | sport fish stocking protocol               | anytime augment/catastrophic events          | fingerling, sub-catchable, catchable |          |

|           |  |  |                   |                   |                              |                                              |                                      |  |
|-----------|--|--|-------------------|-------------------|------------------------------|----------------------------------------------|--------------------------------------|--|
| Statewide |  |  | City Reservoir    | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable            |  |
| Statewide |  |  | City Reservoir    | <sup>2</sup> LEMA | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable            |  |
| Statewide |  |  | Dogtown Reservoir | ONMY              | 71,000                       | spring, summer, fall multiple times annually | sub-catchable, catchable             |  |
| Statewide |  |  | Dogtown Reservoir | SATR              | 24,000                       | fall multiple times annually                 | sub-catchable, catchable             |  |
| Statewide |  |  | Dogtown Reservoir | <sup>1</sup> ICPU | 3,000                        | April-July                                   | catchable                            |  |
| Statewide |  |  | Dogtown Reservoir | <sup>1</sup> ICPU | sport fish stocking protocol | anytime augment/catastrophic event           | fingerling, sub-catchable            |  |
| Statewide |  |  | Dogtown Reservoir | <sup>1</sup> MISA | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Dogtown Reservoir | LEMA              | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable            |  |
| Statewide |  |  | Dogtown Reservoir | <sup>1</sup> LEMI | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable            |  |
| Statewide |  |  | Russell Tank      | <sup>1</sup> ONMY | 8,000                        | March-October multiple times annually        | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Sante Fe Tank     | ONMY              | 16,500                       | spring, fall, summer multiple times annually | sub-catchable, catchable             |  |
| Statewide |  |  | Sante Fe Tank     | SATR              | 7,000                        | fall multiple times annually                 | sub-catchable, catchable             |  |
| Statewide |  |  | Sante Fe Tank     | ICPU              | 1,500                        | spring, summer                               | catchable                            |  |
| Statewide |  |  | Sante Fe Tank     | ICPU              | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable            |  |
| Statewide |  |  | Sante Fe Tank     | <sup>1</sup> MISA | sport fish stocking protocol | anytime augment/catastrophic events          | fingerling, sub-catchable, catchable |  |



|           |  |              |                          |                   |                                                                       |                                            |                                      |                                                                                                                                                                                 |
|-----------|--|--------------|--------------------------|-------------------|-----------------------------------------------------------------------|--------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statewide |  |              | Sante Fe Tank            | LEMA              | sport fish stocking protocol                                          | anytime augment/catastrophic events        | fingerling, sub-catchable            |                                                                                                                                                                                 |
| Statewide |  |              | Sante Fe Tank            | <sup>1</sup> LEMI | sport fish stocking protocol                                          | anytime augment/catastrophic events        | fingerling, sub-catchable            |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | ONMY              | 45,000                                                                | March-November multiple times annually     | sub-catchable, catchable             |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | <sup>1</sup> SATR | 20,000                                                                | September-November multiple times annually | sub-catchable, catchable             |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | ICPU              | 5,000                                                                 | April-July                                 | catchable                            |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | ICPU              | sport fish stocking protocol                                          | anytime augment/catastrophic events        | fingerling, sub-catchable            |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | MISA              | sport fish stocking protocol                                          | anytime augment/catastrophic events        | fingerling, sub-catchable, catchable |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | LEMA              | sport fish stocking protocol                                          | anytime augment/catastrophic events        | fingerling, sub-catchable            |                                                                                                                                                                                 |
| Statewide |  |              | Kaibab Lake              | <sup>2</sup> LEMI | sport fish stocking protocol                                          | anytime augment/catastrophic events        | fingerling, sub-catchable            |                                                                                                                                                                                 |
| Statewide |  | Yuma Complex | LaPaz County Park Pond   | ONMY              | 500-3,000 (generally individual stockings will be 500-1,500 each)     | 2x annually with one stocking in February  | catchable                            | the proposed action is to stock a total of 500-1,500 fish per stocking which may be comprised of catchable ONMY, ICPU, or LEMA. preferred spp is ONMY. See document for details |
| Statewide |  |              | LaPaz County Park Pond   | <sup>2</sup> ICPU | see LaPaz County Park Pond ONMY                                       |                                            | catchable                            |                                                                                                                                                                                 |
| Statewide |  |              | LaPaz County Park Pond   | <sup>2</sup> LEMA | see LaPaz County Park Pond ONMY                                       |                                            | catchable                            |                                                                                                                                                                                 |
| Statewide |  |              | LaPaz County Park Lagoon | ONMY              | 1,000-6,000 (generally individual stockings will be 1,000-3,000 each) | 2x annually with one stocking in February  | catchable                            | the proposed action is to stock a total of 1,000-3,000 fish per stocking which may be comprised of catchable ONMY, ICPU, or                                                     |

|           |                       |                         |                          |                   |                                                              |                                                           |                                |                                                                                                                                                                                             |
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|           |                       |                         |                          |                   |                                                              |                                                           |                                | LEMA, preferred spp is ONMY. See document for details                                                                                                                                       |
| Statewide |                       |                         | LaPaz County Park Lagoon | ICPU              | see LaPaz County Park Lagoon ONMY                            |                                                           | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | LaPaz County Park Lagoon | LEMA              | see LaPaz County Park Lagoon ONMY                            |                                                           | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Yuma West Wetland        | ONMY              | 16,000                                                       | November-March multiple times annually                    | catchable                      | Total number of fish would not exceed 16,000 of any combination of ONMY, ICPU, MISA, or LEMA                                                                                                |
| Statewide |                       |                         | Yuma West Wetland        | ICPU              | see Yuma West Wetland ONMY                                   | anytime                                                   | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Yuma West Wetland        | MISA              | see Yuma West Wetland ONMY                                   | anytime                                                   | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Yuma West Wetland        | LEMA              | see Yuma West Wetland ONMY                                   | anytime                                                   | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Hidden Shores            | ONMY              | 500-4,000 (generally individual stockings will be 500-2,000) | 2x annually with one stocking in spring (likely February) | catchable                      | The intent is to stock ONMY however if that is not feasible due to constraints ICPU, MISA, and/or LEMA may be stocked instead; total numbers would not exceed 4,000 fish of any combination |
| Statewide |                       |                         | Hidden Shores            | <sup>2</sup> MISA | see Hidden Shores ONMY                                       |                                                           | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Hidden Shores            | <sup>2</sup> ICPU | see Hidden Shores ONMY                                       |                                                           | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Hidden Shores            | <sup>1</sup> LEMA | see Hidden Shores ONMY                                       |                                                           | catchable                      |                                                                                                                                                                                             |
| Statewide | Little Colorado River | LCR above Lyman Complex | Hulsey Lake              | ONMY              | 10,000                                                       | April-July multiple times annually                        | catchable                      |                                                                                                                                                                                             |
| Statewide |                       |                         | Pratt Lake               | ONMY              | 10,000(sub-catchable) 2,000(catchable)                       | April-June (if conditions suitable)                       | sub-catchable and/or catchable | stocked multiple times annually based on water level, quality, weed growth, and fish availability                                                                                           |

|           |  |               |                                                        |                   |                                      |                                                      |                                      |                                                                                                              |
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| Statewide |  |               | Nelson Reservoir                                       | ONMY              | 20,000                               | April-July multiple times annually                   | catchable                            | stocking occurs following cessation of spring spill                                                          |
| Statewide |  |               | Lyman Reservoir                                        | <sup>1</sup> ONMY | 10,000                               | year round                                           | catchable                            | stocked multiple times annually based on water level, quality, weed growth, and fish availability            |
| Statewide |  |               | Carnero Lake                                           | ONMY              | 20,000                               | April-June multiple times annually                   | sub-catchable, catchable             |                                                                                                              |
| Statewide |  |               | Becker Lake                                            | ONMY              | 16,000                               | March-May multiple times annually                    | sub-catchable, catchable             |                                                                                                              |
| Statewide |  |               | Becker Lake                                            | <sup>1</sup> ONAP | 8,000                                | March-May multiple times annually                    | catchable                            |                                                                                                              |
| Statewide |  |               | Becker Lake                                            | <sup>2</sup> THAR | 5,000                                | March-May                                            | sub-catchable                        |                                                                                                              |
| Statewide |  | West Fork LCR | Mexican Hay Lake                                       | <sup>2</sup> ONAP | 10,000                               | April-June annually                                  | catchable                            | typically stocked 1x year in spring/summer only if water level sufficient to support trout throughout summer |
| Statewide |  |               | Lee Valley Lake                                        | ONAP              | 7,500                                | April-June annually                                  | catchable                            |                                                                                                              |
| Statewide |  |               | Lee Valley Lake                                        | THAR              | 30,000                               | April-October annually                               | fingerling, sub-catchable            |                                                                                                              |
| Statewide |  |               | Bunch Reservoir                                        | ONMY              | 15,000                               | April-September                                      | catchable                            |                                                                                                              |
| Statewide |  |               | River Reservoir                                        | ONMY              | 40,000                               | April-September                                      | sub-catchable, catchable             |                                                                                                              |
| Statewide |  |               | Tunnel Reservoir                                       | ONMY              | 20,000                               | April-September                                      | catchable                            |                                                                                                              |
| Statewide |  |               | Bunch Reservoir<br>Tunnel Reservoir<br>River Reservoir | <sup>2</sup> ONAP | not to exceed 15,000 for all 3 lakes | April-September only when surplus in hatchery occurs | fingerling, sub-catchable, catchable | for further explanation see watershed document                                                               |
| Statewide |  |               | White Mountain Reservoir                               | <sup>1</sup> ONMY | 30,000                               | April-June                                           | sub-catchable, catchable             | stocked only in years when reservoir is expected to hold water through the summer                            |
| Statewide |  |               | LCR Greer                                              | ONAP              | 35,000                               | May-September multiple times annually                | catchable                            |                                                                                                              |

|           |  |                        |                      |                   |                              |                                                                     |                                      |                                                                                                                                                                     |
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| Statewide |  |                        | LCR Greer            | ONMY              | see LCR Greer ONAP           |                                                                     | catchable                            | ONMY will be stocked if ONAP numbers from hatchery are insufficient to meet targeted goal; ONMY will be stocked to make up the difference (a total of 35,000 trout) |
| Statewide |  |                        | LCR Sheeps Crossing  | ONAP              | 12,000                       | May-September multiple times annually                               | catchable                            |                                                                                                                                                                     |
| Statewide |  | Upper LCR              | Little Ortega        | ICPU              | 10,000                       | April-September multiple times annually                             | fingerling, sub-catchable, catchable | stocked opportunistically when the lake has sufficient water levels                                                                                                 |
| Statewide |  |                        | Concho Lake          | ONMY              | 15,000                       | March-June multiple times annually                                  | catchable                            |                                                                                                                                                                     |
| Statewide |  |                        | Concho Lake          | <sup>2</sup> MISA | sport fish stocking protocol | anytime augment fishery/catastrophic events                         | fingerling, sub-catchable, catchable | stocked initially to establish fishery. Following stockings will be only to augment fishery/catastrophic events                                                     |
| Statewide |  |                        | Concho Lake          | <sup>2</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic events                         | fingerling, sub-catchable, catchable |                                                                                                                                                                     |
| Statewide |  |                        | Concho Lake          | <sup>1</sup> ICPU | 20,000                       | April-September                                                     | fingerling, sub-catchable, catchable | stocked annually only if warm water fishery is initialized                                                                                                          |
| Statewide |  | White Mountain Complex | Sponseller           | ONMY              | 10,000                       | March-June multiple times annually                                  | sub-catchable, catchable             | stocked opportunistically multiple times annually based on water level, quality, weed growth, and fish availability                                                 |
| Statewide |  |                        | Silver Creek         | ONAP              | 15,000                       | May-September (weekly); October-January (support catch and release) | catchable                            | ONMY and ONAP will be stocked to meet a total of 15,000 trout                                                                                                       |
| Statewide |  |                        | Silver Creek         | ONMY              | see Silver Creek ONAP        |                                                                     | catchable                            |                                                                                                                                                                     |
| Statewide |  |                        | Long Lake (Show Low) | <sup>1</sup> ONMY | 40,000                       | March-June multiple times annually                                  | fingerling, sub-catchable, catchable | stocked opportunistically when the lake has sufficient water levels                                                                                                 |

|           |  |                     |                       |                   |                              |                                               |                                          |                                                                                                                                                                                                                                              |
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| Statewide |  |                     | Whipple               | <sup>1</sup> ICPU | 8,000                        | May-September<br>multiple times<br>annually   | fingerling, sub-<br>catchable, catchable | stocked<br>opportunistically when<br>the lake has sufficient<br>water levels                                                                                                                                                                 |
| Statewide |  |                     | Little Mormon<br>Lake | <sup>1</sup> ICPU | 10,000                       | May-September<br>multiple times<br>annually   | catchable                                | stocked<br>opportunistically when<br>the lake has sufficient<br>water levels                                                                                                                                                                 |
| Statewide |  | Schoen's<br>Complex | Woodland Lake         | ONMY              | 20,000                       | April-September<br>multiple times<br>annually | catchable                                |                                                                                                                                                                                                                                              |
| Statewide |  |                     | Woodland Lake         | ICPU              | 2,000                        | April-September                               | fingerling, sub-<br>catchable, catchable | stocked<br>opportunistically<br>depending on water<br>quality and fish<br>availability                                                                                                                                                       |
| Statewide |  |                     | Woodland Lake         | LEMA              | 5,000                        | April-September                               | catchable                                | stocked to support<br>fishing clinics                                                                                                                                                                                                        |
| Statewide |  |                     | Rainbow Lake          | ONMY              | 30,000                       | April-September<br>multiple times<br>annually | sub-catchable,<br>catchable              |                                                                                                                                                                                                                                              |
| Statewide |  |                     | Rainbow Lake          | ICPU              | 15,000                       | April-September                               | fingerling, sub-<br>catchable, catchable | stocked<br>opportunistically<br>depending on water<br>quality and fish<br>availability                                                                                                                                                       |
| Statewide |  |                     | Rainbow Lake          | LEMA              | 5,000                        | April-September                               | catchable                                | stocked to support<br>fishing clinics                                                                                                                                                                                                        |
| Statewide |  |                     | Rainbow Lake          | MISA              | sport fish stocking protocol | anytime augment/<br>catastrophic events       | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                                                                              |
| Statewide |  |                     | Rainbow Lake          | LEMA              | sport fish stocking protocol | anytime augment/<br>catastrophic events       | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                                                                              |
| Statewide |  |                     | Show Low<br>Lake      | ONMY              | 250,000                      | April-September                               | fingerling, sub-<br>catchable, catchable | This lake would be<br>stocked multiple times<br>annually based on<br>water level, quality,<br>and fish availability.<br>Total numbers of trout<br>would not exceed<br>250,000 fish of any<br>combination of<br>ONMY, SAFO,<br>ONAP, and ONCL |
| Statewide |  |                     | Show Low<br>Lake      | <sup>1</sup> SAFO | see ONMY Show Low Lake       |                                               | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                                                                              |
| Statewide |  |                     | Show Low<br>Lake      | <sup>1</sup> ONCL | see ONMY Show Low Lake       |                                               | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                                                                              |

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| Statewide |  |  | Show Low Lake     | <sup>2</sup> ONAP | see ONMY Show Low Lake       |                                         | fingerling, sub-catchable, catchable |                                                                                                                                                                                                                |
| Statewide |  |  | Show Low Lake     | ICPU              | 15,000                       | April-September                         | fingerling, sub-catchable, catchable | stocked opportunistically depending on fish availability                                                                                                                                                       |
| Statewide |  |  | Show Low Lake     | LEMA              | 5,000                        | April-September                         | catchable                            | stocked to support fishing clinics                                                                                                                                                                             |
| Statewide |  |  | Show Low Lake     | LEMA              | sport fish stocking protocol | anytime augment/catastrophic events     | fingerling, sub-catchable, catchable |                                                                                                                                                                                                                |
| Statewide |  |  | Fools Hollow Lake | ONMY              | 200,000                      | April-September multiple times annually | fingerling, sub-catchable, catchable | This lake would be stocked multiple times annually based on water level, quality, and fish availability. Total numbers of trout would not exceed 200,000 fish of any combination of ONMY, SAFO, ONAP, and ONCL |
| Statewide |  |  | Fools Hollow Lake | <sup>2</sup> ONAP | see ONMY Fools Hollow Lake   |                                         | fingerling, sub-catchable, catchable |                                                                                                                                                                                                                |
| Statewide |  |  | Fools Hollow Lake | <sup>1</sup> ONCL | see ONMY Fools Hollow Lake   |                                         | fingerling, sub-catchable, catchable |                                                                                                                                                                                                                |
| Statewide |  |  | Fools Hollow Lake | <sup>2</sup> SAFO | see ONMY Fools Hollow Lake   |                                         | fingerling, sub-catchable, catchable |                                                                                                                                                                                                                |
| Statewide |  |  | Fools Hollow Lake | ICPU              | 15,000                       | April-September                         | fingerling, sub-catchable, catchable | stocked opportunistically depending on water quality and fish availability                                                                                                                                     |
| Statewide |  |  | Fools Hollow Lake | LEMA              | 5,000                        | April-September                         | catchable                            | stocked to support fishing clinics                                                                                                                                                                             |
| Statewide |  |  | Fools Hollow Lake | LEMA              | sport fish stocking protocol | anytime augment/catastrophic events     | fingerling, sub-catchable, catchable |                                                                                                                                                                                                                |
| Statewide |  |  | Scotts Reservoir  | ONMY              | 30,000                       | April-September multiple times annually | sub-catchable, catchable             |                                                                                                                                                                                                                |
| Statewide |  |  | Scotts Reservoir  | ICPU              | 15,000                       | April-September                         | fingerling, sub-catchable, catchable | stocked opportunistically depending on fish availability                                                                                                                                                       |
| Statewide |  |  | Scotts Reservoir  | LEMA              | 5,000                        | April-September                         | catchable                            | stocked to support fishing clinics                                                                                                                                                                             |

| Statewide |  |                        | Scotts Reservoir                     | LEMA              | sport fish stocking protocol                  | anytime augment/<br>catastrophic events       | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                       |
|-----------|--|------------------------|--------------------------------------|-------------------|-----------------------------------------------|-----------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statewide |  |                        | Show Low Creek                       | <sup>1</sup> ONMY | 10,000                                        | April-September<br>multiple times<br>annually | catchable                                |                                                                                                                                                                                       |
| Statewide |  |                        | Mountain Meadow Recreational Complex | <sup>2</sup> ONMY | 5,000                                         | March-November                                | catchable                                | Intent is to stock for fishing clinics/derby based on time of year/availability/cost . Stocked # would be a combination or specific targeted spp for event and would not exceed 5,000 |
| Statewide |  |                        | Mountain Meadow Recreational Complex | <sup>2</sup> LEMA | see ONMY Mountain Meadow Recreational Complex |                                               | catchable                                |                                                                                                                                                                                       |
| Statewide |  | Chevelon Creek Complex | Chevelon Canyon Lake                 | ONMY              | 140,000                                       | May-September<br>multiple times<br>annually   | fingerling, sub-<br>catchable            |                                                                                                                                                                                       |
| Statewide |  |                        | Chevelon Canyon Lake                 | <sup>1</sup> THAR | 10,000                                        | May-September<br>multiple times<br>annually   | fingerling, sub-<br>catchable            |                                                                                                                                                                                       |
| Statewide |  |                        | Long Tom                             | <sup>1</sup> ONMY | 3,000                                         | May-September<br>multiple times<br>annually   | catchable                                |                                                                                                                                                                                       |
| Statewide |  |                        | Willow Springs                       | ONMY              | 100,000                                       | April-September<br>multiple times<br>annually | catchable                                |                                                                                                                                                                                       |
| Statewide |  |                        | Woods Canyon                         | ONMY              | 120,000                                       | April-September<br>multiple times<br>annually | catchable                                |                                                                                                                                                                                       |
| Statewide |  | Black Canyon Lake      | Black Canyon Lake                    | ONMY              | 40,000                                        | April-September                               | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                       |
| Statewide |  |                        | Black Canyon Lake                    | <sup>1</sup> SAFO | 15,000                                        | April-September                               | fingerling, sub-<br>catchable, catchable |                                                                                                                                                                                       |
| Statewide |  | Clear Creek Complex    | Bear Canyon Lake                     | ONMY              | 30,000                                        | April-September<br>multiple times<br>annually | Catchable                                |                                                                                                                                                                                       |
| Statewide |  |                        | Bear Canyon Lake                     | <sup>1</sup> THAR | 15,000                                        | April-September<br>multiple times<br>annually | fingerling, sub-<br>catchable            |                                                                                                                                                                                       |
| Statewide |  |                        | C.C. Craigin (Blue Ridge Reservoir)  | ONMY              | 15,000                                        | May-June multiple<br>times annually           | Catchable                                | stocking will occur only when reservoir stops spilling following spring snow melt                                                                                                     |

|           |  |                       |                       |                   |                                              |                                               |                                      |                                                                                                                                   |
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| Statewide |  |                       | Knoll Lake            | ONMY              | 20,000                                       | May-July multiple times annually              | Catchable                            | stocking will occur only when reservoir stops spilling following spring snow melt                                                 |
| Statewide |  | Clear Creek Reservoir | Clear Creek Reservoir | <sup>1</sup> ONMY | 15,000                                       | April-June (following spring runoff annually) | Catchable                            | trout may be stocked multiple times per season, but focused during the late spring/early summer following spring runoff           |
| Statewide |  | Jack's Canyon Complex | Soldiers Annex        | 1 ONMY            | 25,000                                       | spring, fall multiple times annually          | catchable                            | stocking focused during spring, fall, may be stocked multiple times annually based on water level, quality, and fish availability |
| Statewide |  |                       | Soldiers Annex        | MISA              | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | fingerling, sub-catchable, catchable |                                                                                                                                   |
| Statewide |  |                       | Soldiers Annex        | ICPU              | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Soldiers Annex        | LEMA              | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Soldiers Annex        | <sup>2</sup> PEFL | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | fry, fingerling, sub-catchable       |                                                                                                                                   |
| Statewide |  |                       | Long Lake (Diablo)    | ONMY              | 480,000 (may include up to 20,000 catchable) | spring (could occur multiple times annually)  | fingerling, sub-catchable, catchable | stocking focused during spring, may be stocked multiple times annually based on water level, quality, and fish availability       |
| Statewide |  |                       | Long Lake (Diablo)    | <sup>1</sup> ICPU | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | fingerling, sub-catchable,           |                                                                                                                                   |
| Statewide |  |                       | Long Lake (Diablo)    | SAVI              | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | sac fry, fingerling                  |                                                                                                                                   |
| Statewide |  |                       | Long Lake (Diablo)    | MISA              | sport fish stocking protocol                 | anytime augment fishery/catastrophic events   | fingerling, sub-catchable, catchable |                                                                                                                                   |



|           |  |                       |                    |                   |                              |                                             |                                      |                                                                                                                                   |
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| Statewide |  |                       | Long Lake (Diablo) | LEMA              | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Long Lake (Diablo) | <sup>2</sup> PEFL | sport fish stocking protocol | anytime augment fishery/catastrophic events | fry, fingerling, sub-catchable       |                                                                                                                                   |
| Statewide |  |                       | Soldiers           | <sup>1</sup> ONMY | 25,000                       | spring, fall multiple times annually        | catchable                            | stocking focused during spring, fall, may be stocked multiple times annually based on water level, quality, and fish availability |
| Statewide |  |                       | Soldiers           | ICPU              | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Soldiers           | MISA              | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable, catchable |                                                                                                                                   |
| Statewide |  |                       | Soldiers           | LEMA              | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Soldiers           | <sup>2</sup> PEFL | sport fish stocking protocol | anytime augment fishery/catastrophic events | fry, fingerling, sub-catchable       |                                                                                                                                   |
| Statewide |  |                       | Tremaine Lake      | <sup>2</sup> ICPU | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Tremaine Lake      | <sup>2</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  |                       | Tremaine Lake      | <sup>2</sup> MISA | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable, catchable |                                                                                                                                   |
| Statewide |  |                       | Tremaine Lake      | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                   |
| Statewide |  | Canyon Diablo complex | Mud Tank           | <sup>1</sup> ONMY | 5,000                        | April-November multiple times annually      | catchable                            | This lake would be stocked multiple times annually based on water level, quality, and fish availability                           |

|           |  |  |                    |                   |        |                                            |                                      |                                                        |
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| Statewide |  |  | Kinnikinick Lake   | ONMY              | 50,000 | March-November multiple times annually     | sub-catchable, catchable             |                                                        |
| Statewide |  |  | Kinnikinick Lake   | SATR              | 20,000 | September-November multiple times annually | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Kinnikinick Lake   | <sup>1</sup> SAFO | 50,000 | April-November multiple times annually     | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Kinnikinick Lake   | <sup>1</sup> THAR | 50,000 | March-November                             | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Kinnikinick Lake   | <sup>1</sup> ONCL | 50,000 | April-November multiple times annually     | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Coconino Lake      | <sup>1</sup> ONMY | 5,000  | March-November multiple times annually     | sub-catchable, catchable             |                                                        |
| Statewide |  |  | Coconino Lake      | <sup>1</sup> SATR | 5,000  | March-November                             | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Coconino Lake      | <sup>2</sup> SAFO | 5,000  | March-November                             | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Coconino Lake      | <sup>1</sup> ONCL | 5,000  | March-November                             | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Coconino Lake      | <sup>2</sup> THAR | 5,000  | March-November                             | fingerling, sub-catchable, catchable |                                                        |
| Statewide |  |  | Morton             | <sup>1</sup> ONMY | 5,000  | March-November                             | catchable                            |                                                        |
| Statewide |  |  | Ashurst Lake       | ONMY              | 80,000 | March-November                             | sub-catchable, catchable             |                                                        |
| Statewide |  |  | Ashurst Lake       | <sup>1</sup> ICPU | 2,000  | April-November                             | sub-catchable, catchable             |                                                        |
| Statewide |  |  | Ashurst Lake       | <sup>1</sup> ONCL | 50,000 | March-November                             | fingerling, sub-catchable, catchable | may be stocked opportunistically if fish are available |
| Statewide |  |  | Ashurst Lake       | <sup>1</sup> SATR | 50,000 | March-November                             | fingerling, sub-catchable, catchable | may be stocked opportunistically if fish are available |
| Statewide |  |  | Ashurst Lake       | <sup>1</sup> SAFO | 50,000 | March-November                             | fingerling, sub-catchable, catchable | may be stocked opportunistically if fish are available |
| Statewide |  |  | Ashurst Lake       | <sup>1</sup> THAR | 10,000 | March-November                             | fingerling, sub-catchable, catchable | may be stocked opportunistically if fish are available |
| Statewide |  |  | Frances Short Pond | ONMY              | 8,000  | March-November multiple times annually     | catchable                            |                                                        |

|           |  |                      |                    |                   |                              |                                                |                                      |                                                                                                                                                                                                               |
|-----------|--|----------------------|--------------------|-------------------|------------------------------|------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statewide |  |                      | Frances Short Pond | ICPU              | 2,500                        | April-July multiple times annually             | catchable                            |                                                                                                                                                                                                               |
| Statewide |  |                      | Frances Short Pond | LEMA              | sport fish stocking protocol | anytime to augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                                                                                               |
| Statewide |  |                      | Frances Short Pond | <sup>2</sup> LEMI | sport fish stocking protocol | anytime to augment fishery/catastrophic events | fingerling, sub-catchable            |                                                                                                                                                                                                               |
| Statewide |  |                      | Frances Short Pond | MISA              | sport fish stocking protocol | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |                                                                                                                                                                                                               |
| Statewide |  | Walnut Creek complex | Marshall Lake      | <sup>1</sup> ONMY | 10,000                       | March-November multiple times annually         | sub-catchable, catchable             |                                                                                                                                                                                                               |
| Statewide |  |                      | Marshall Lake      | SAFO              | 1,000                        | March-June                                     | fingerling                           |                                                                                                                                                                                                               |
| Statewide |  |                      | Marshall Lake      | THAR              | 1,000                        | March-June                                     | fingerling                           |                                                                                                                                                                                                               |
| Statewide |  |                      | Mormon Lodge Pond  | ONMY              | 4,500                        | March-November multiple times annually         | sub-catchable, catchable             |                                                                                                                                                                                                               |
| Statewide |  |                      | Mormon Lodge Pond  | <sup>2</sup> LEMA | sport fish stocking protocol | anytime establish/augment/catastrophic event   | fingerling, sub-catchable            |                                                                                                                                                                                                               |
| Statewide |  |                      | Mormon Lodge Pond  | <sup>2</sup> LEMI | sport fish stocking protocol | anytime establish/augment/catastrophic event   | fingerling, sub-catchable            |                                                                                                                                                                                                               |
| Statewide |  |                      | Upper Lake Mary    | ICPU              | 10,000                       | April-July multiple times annually             | catchable, sub-catchable             |                                                                                                                                                                                                               |
| Statewide |  |                      | Upper Lake Mary    | ICPU              | sport fish stocking protocol | anytime augment/catastrophic event             | fingerling, sub-catchable            |                                                                                                                                                                                                               |
| Statewide |  |                      | Upper Lake Mary    | <sup>1</sup> ONMY | 160,000                      | March-November multiple times annually         | fingerling, sub-catchable, catchable | This lake would be stocked multiple times annually based on water level, quality, and fish availability total numbers of trout would not exceed 160,000 fish of any combination of ONMY, SATR, SAFO, and ONCL |
| Statewide |  |                      | Upper Lake Mary    | <sup>1</sup> SATR | see Upper Lake Mary ONMY     |                                                | fingerling, sub-catchable, catchable |                                                                                                                                                                                                               |

|           |                                     |                 |                 |                   |                                      |                                               |                                      |                                                                                                              |
|-----------|-------------------------------------|-----------------|-----------------|-------------------|--------------------------------------|-----------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Statewide |                                     |                 | Upper Lake Mary | <sup>1</sup> ONCL | see Upper Lake Mary ONMY             |                                               | fingerling, sub-catchable, catchable |                                                                                                              |
| Statewide |                                     |                 | Upper Lake Mary | <sup>2</sup> SAFO | see Upper Lake Mary ONMY             |                                               | fingerling, sub-catchable, catchable |                                                                                                              |
| Statewide |                                     |                 | Upper Lake Mary | LEMA              | sport fish stocking protocol         | anytime to augment fishery/catastrophic event | fingerling, sub-catchable            |                                                                                                              |
| Statewide |                                     |                 | Upper Lake Mary | <sup>1</sup> LEMI | sport fish stocking protocol         | anytime to augment fishery/catastrophic event | fingerling, sub-catchable            |                                                                                                              |
| Statewide |                                     |                 | Lower Lake Mary | ONMY              | 120,000                              | March-November multiple times annually        | fingerling, sub-catchable, catchable | This lake would be stocked multiple times annually based on water level, quality, and fish availability      |
| Statewide |                                     |                 | Lower Lake Mary | <sup>1</sup> ICPU | 5,000                                | April-July                                    | catchable                            |                                                                                                              |
| Statewide |                                     |                 | Lower Lake Mary | <sup>1</sup> ICPU | sport fish stocking protocol         | anytime to augment fishery/catastrophic event | fingerling, sub-catchable            |                                                                                                              |
| Statewide |                                     |                 | Lower Lake Mary | <sup>1</sup> LEMA | sport fish stocking protocol         | anytime to augment fishery/catastrophic event | fingerling, sub-catchable            |                                                                                                              |
| Statewide |                                     |                 | Lower Lake Mary | <sup>1</sup> LEMI | sport fish stocking protocol         | anytime to augment fishery/catastrophic event | fingerling, sub-catchable            |                                                                                                              |
| Statewide | <b>Whitewater Draw-Wilcox Playa</b> | Riggs Flat Lake | Riggs Flat Lake | ONMY              | 30,000                               | April-October multiple times annually         | catchable                            |                                                                                                              |
| Statewide |                                     |                 | Riggs Flat Lake | SATR              | 10,000(fingerling) 10,000(catchable) | April-October multiple times annually         | fingerling, catchable                | stockings of catchable SATR and SAFO only occur periodically to promote and increase interest in the fishery |
| Statewide |                                     |                 | Riggs Flat Lake | SAFO              | 10,000(fingerling) 10,000(catchable) | April-October multiple times annually         | fingerling, catchable                | stockings of catchable SATR and SAFO only occur periodically to promote and increase interest in the fishery |
| Statewide |                                     |                 | Riggs Flat Lake | <sup>2</sup> CTID | 1,000                                | April-October                                 | up to 15 inches                      |                                                                                                              |
| Statewide | <b>Gila River</b>                   | Upper Gila      | Cluff Pond #3   | ONMY              | 20,000                               | November-March multiple times annually        | catchable                            |                                                                                                              |

|           |  |  |                |                   |                                                       |                                                                                                   |                                      |  |
|-----------|--|--|----------------|-------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|--|
| Statewide |  |  | Cluff Pond #3  | <sup>1</sup> CTID | 1,000                                                 | as needed to control aquatic vegetation                                                           | up to 15 inches                      |  |
| Statewide |  |  | Cluff Pond #3  | <sup>1</sup> ICPU | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | sub-catchable, catchable             |  |
| Statewide |  |  | Cluff Pond #3  | MISA              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Cluff Pond #3  | LEMA              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Cluff Pond #3  | <sup>2</sup> LEMI | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Cluff Pond #3  | PONI              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | sub-catchable, catchable             |  |
| Statewide |  |  | Dankworth Pond | ONMY              | 20,000                                                | November-March multiple times annually                                                            | catchable                            |  |
| Statewide |  |  | Dankworth Pond | <sup>2</sup> CTID | 1,000                                                 | as needed to control aquatic vegetation                                                           | up to 15 inches                      |  |
| Statewide |  |  | Dankworth Pond | ICPU              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | sub-catchable, catchable             |  |
| Statewide |  |  | Dankworth Pond | MISA              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Dankworth Pond | PONI              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | sub-catchable, catchable             |  |
| Statewide |  |  | Dankworth Pond | LEMA              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Dankworth Pond | LEMI              | sport fish stocking protocol                          | anytime to augment/catastrophic events                                                            | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Frye Mesa Lake | ONMY              | 30,000                                                | April-late September multiple times annually                                                      | catchable                            |  |
| Statewide |  |  | Frye Mesa Lake | ONGI              | 25,000                                                | anytime periodically as available                                                                 | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Frye Mesa Lake | SATR              | 10,000(fingerling/sub-catchable)<br>10,000(catchable) | September (fingerling/sub-catchable)/anytime augment fishery depending on availability(catchable) | fingerling, sub-catchable, catchable |  |
| Statewide |  |  | Frye Mesa Lake | <sup>1</sup> SAFO | 10,000(fingerling/sub-catchable)<br>10,000(catchable) | anytime periodically as available                                                                 | fingerling, sub-catchable, catchable |  |

|           |                            |                           |                       |                   |                                                      |                                                        |                                      |  |
|-----------|----------------------------|---------------------------|-----------------------|-------------------|------------------------------------------------------|--------------------------------------------------------|--------------------------------------|--|
| Statewide |                            |                           | Graham Co Fairgrounds | <sup>1</sup> ONMY | 10,000                                               | November-March multiple times annually                 | catchable                            |  |
| Statewide |                            |                           | Graham Co Fairgrounds | <sup>1</sup> ICPU | 5,000                                                | summer typically May-September multiple times annually | catchable                            |  |
| Statewide |                            |                           | Roper Lake            | ONMY              | 30,000                                               | November-March multiple times annually                 | catchable                            |  |
| Statewide |                            |                           | Roper Lake            | <sup>2</sup> CTID | 1,000                                                | as needed to control aquatic vegetation                | up to 15 inches                      |  |
| Statewide |                            |                           | Roper Lake            | ICPU              | sport fish stocking protocol                         | anytime to augment/catastrophic event                  | sub-catchable, catchable             |  |
| Statewide |                            |                           | Roper Lake            | MISA              | sport fish stocking protocol                         | anytime to augment/catastrophic event                  | fingerling, sub-catchable, catchable |  |
| Statewide |                            |                           | Roper Lake            | PONI              | sport fish stocking protocol                         | anytime to augment/catastrophic event                  | sub-catchable, catchable             |  |
| Statewide |                            |                           | Roper Lake            | LEMA              | sport fish stocking protocol                         | anytime to augment/catastrophic event                  | fingerling, sub-catchable, catchable |  |
| Statewide |                            |                           | Roper Lake            | LEMI              | sport fish stocking protocol                         | anytime to augment/catastrophic event                  | fingerling, sub-catchable, catchable |  |
| Statewide |                            | Kearny                    | Kearny                | <sup>1</sup> ONMY | 20,000                                               | November-March multiple times annually                 | catchable                            |  |
| Statewide |                            |                           | Kearny                | <sup>2</sup> ICPU | 40,000                                               | April-October multiple times annually                  | catchable                            |  |
| Statewide |                            |                           | Kearny                | <sup>1</sup> MISA | 10,000                                               | anytime augment fishery                                | catchable                            |  |
| Statewide |                            |                           | Kearny                | <sup>2</sup> LEMA | 10,000                                               | anytime augment fishery                                | catchable                            |  |
| Statewide |                            |                           | Kearny                | <sup>2</sup> LEMI | 10,000                                               | anytime augment fishery                                | catchable                            |  |
| Statewide | <b>San Francisco River</b> | Luna Lake                 | Luna Lake             | ONMY              | 200,000                                              | April-November multiple times annually                 | fingerling, sub-catchable, catchable |  |
| Statewide |                            |                           | Luna Lake             | ONCL              | 100,000                                              | April-November multiple times annually                 | fingerling, sub-catchable, catchable |  |
| Statewide |                            | Lower Gila - Yuma Complex | Fortuna Pond          | ONMY              | 16,000 (approximately 1,000-4,000 fish per stocking) | October-March (4xyear)                                 | catchable                            |  |

|           |                        |                         |                     |                   |                                                      |                                                          |                          |                                                                                                                                                                                                                                                           |
|-----------|------------------------|-------------------------|---------------------|-------------------|------------------------------------------------------|----------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statewide |                        |                         | Fortuna Pond        | ICPU              | 16,000 (approximately 1,000-4,000 fish per stocking) | multiple times annually (typically during warmer months) | catchable                |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Fortuna Pond        | MISA              | sport fish stocking protocol                         | anytime to augment fishery/catastrophic event            | catchable, sub-catchable |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Fortuna Pond        | LEMA              | sport fish stocking protocol                         | anytime to augment fishery/catastrophic event            | catchable, sub-catchable |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Redondo/Yuma Lake   | <sup>2</sup> ONMY | 16,000 (approximately 1,000-4,000 fish per stocking) | October-March (4xyear)                                   | catchable                |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Redondo/Yuma Lake   | ICPU              | 16,000 (approximately 1,000-4,000 fish per stocking) | multiple times annually (typically during warmer months) | catchable                |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Redondo/Yuma Lake   | MISA              | sport fish stocking protocol                         | anytime to augment fishery/catastrophic event            | catchable, sub-catchable |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Redondo/Yuma Lake   | LEMA              | sport fish stocking protocol                         | anytime to augment fishery/catastrophic event            | catchable, sub-catchable |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Wellton Golf Course | <sup>2</sup> ONMY | 2,000                                                | 1x per year anytime                                      | catchable                | Intent is to stock for fishing clinics/derby based on time of year/availability/cost . Stocked # would be a combination or specific targeted spp for event and would not to exceed 2,000. Sub-catchable LEMA or MISA may be stocked in place of catchable |
| Statewide |                        |                         | Wellton Golf Course | <sup>2</sup> ICPU | see Wellton Golf Course ONMY                         |                                                          | catchable                |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Wellton Golf Course | <sup>2</sup> LEMA | see Wellton Golf Course ONMY                         |                                                          | catchable, sub-catchable |                                                                                                                                                                                                                                                           |
| Statewide |                        |                         | Wellton Golf Course | <sup>2</sup> MISA | see Wellton Golf Course ONMY                         |                                                          | catchable, sub-catchable |                                                                                                                                                                                                                                                           |
| Statewide | <b>Agua Fria River</b> | Agua Fria River Complex | Fain Lake           | ONMY              | 30,000                                               | 2x month annually except July-August                     | sub-catchable, catchable |                                                                                                                                                                                                                                                           |

|           |  |  |                   |                   |                              |                                                |                                      |                                                                                            |
|-----------|--|--|-------------------|-------------------|------------------------------|------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------|
| Statewide |  |  | Fain Lake         | <sup>1</sup> SAFO | 25,000                       | multiple times annually                        | sub-catchable, catchable             | total numbers of trout would not exceed 25,000 fish of any combination of SATR, SAFO, ONCL |
| Statewide |  |  | Fain Lake         | <sup>2</sup> SATR | see Fain Lake SAFO           |                                                | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Fain Lake         | <sup>2</sup> ONCL | see Fain Lake SAFO           |                                                | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Fain Lake         | LEMA              | 3,000                        | anytime for fishing clinics/special events     | catchable                            |                                                                                            |
| Statewide |  |  | Fain Lake         | LEMA              | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | fingerling, sub-catchable, catchable |                                                                                            |
| Statewide |  |  | Fain Lake         | MISA              | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | fingerling, sub-catchable, catchable |                                                                                            |
| Statewide |  |  | Fain Lake         | <sup>2</sup> POAN | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Fain Lake         | ICPU              | 3,000                        | anytime for fishing clinics/special events     | catchable                            |                                                                                            |
| Statewide |  |  | Fain Lake         | ICPU              | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Horse Thief Basin | ICPU              | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Horse Thief Basin | MISA              | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | fingerling, sub-catchable, catchable |                                                                                            |
| Statewide |  |  | Horse Thief Basin | <sup>2</sup> LEMA | sport fish stocking protocol | anytime to augment fishery/catastrophic event  | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Lynx Lake         | <sup>1</sup> ONMY | 30,000                       | 2x month annually except July-August           | sub-catchable, catchable             |                                                                                            |
| Statewide |  |  | Lynx Lake         | LEMA              | 3,000                        | anytime for fishing clinics/special events     | catchable                            |                                                                                            |
| Statewide |  |  | Lynx Lake         | LEMA              | sport fish stocking protocol | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |                                                                                            |



|           |                   |                     |                       |                   |                                |                                                |                                      |                                                                                                                                                                     |
|-----------|-------------------|---------------------|-----------------------|-------------------|--------------------------------|------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statewide |                   |                     | Lynx Lake             | <sup>1</sup> SATR | 50,000                         | multiple times annually                        | sub-catchable, catchable             | total numbers of trout would not exceed 50,000 fish of any combination of SATR, SAFO, ONCL                                                                          |
| Statewide |                   |                     | Lynx Lake             | SAFO              | see Lynx Lake SATR             |                                                | sub-catchable, catchable             |                                                                                                                                                                     |
| Statewide |                   |                     | Lynx Lake             | <sup>1</sup> ONCL | see Lynx Lake SATR             |                                                | sub-catchable, catchable             |                                                                                                                                                                     |
| Statewide |                   |                     | Lynx Lake             | MISA              | sport fish stocking protocol   | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |                                                                                                                                                                     |
| Statewide |                   |                     | Lynx Lake             | <sup>2</sup> POAN | sport fish stocking protocol   | anytime to augment fishery/catastrophic events | sub-catchable, catchable             |                                                                                                                                                                     |
| Statewide |                   |                     | Lynx Lake             | ICPU              | 3,000                          | anytime for fishing clinics/special events     | catchable                            |                                                                                                                                                                     |
| Statewide |                   |                     | Lynx Lake             | ICPU              | sport fish stocking protocol   | anytime to augment fishery/catastrophic events | sub-catchable, catchable             |                                                                                                                                                                     |
| Statewide | <b>Salt River</b> | Black River Complex | Ackre Lake            | ONAP              | 750                            | several times x year                           | catchable                            |                                                                                                                                                                     |
| Statewide |                   |                     | Ackre Lake            | THAR              | 750                            | several times x year                           | sub-catchable                        |                                                                                                                                                                     |
| Statewide |                   |                     | Big Lake              | ONMY              | 300,000                        | April-October multiple times annually          | fingerling, sub-catchable, catchable |                                                                                                                                                                     |
| Statewide |                   |                     | Big Lake              | SAFO              | 130,000                        | April-October multiple times annually          | fingerling, sub-catchable, catchable |                                                                                                                                                                     |
| Statewide |                   |                     | Big Lake              | ONCL              | 130,000                        | April-October multiple times annually          | fingerling, sub-catchable, catchable |                                                                                                                                                                     |
| Statewide |                   |                     | Big Lake              | <sup>1</sup> ONAP | 5,000                          | April-October multiple times annually          | fingerling, sub-catchable, catchable |                                                                                                                                                                     |
| Statewide |                   |                     | Black River East Fork | ONAP              | 40,000                         | May-September                                  | catchable                            | ONMY will be stocked if ONAP numbers from hatchery are insufficient to meet targeted goal; ONMY will be stocked to make up the difference (a total of 40,000 trout) |
| Statewide |                   |                     | Black River East Fork | <sup>1</sup> ONMY | see Black River East Fork ONAP |                                                | catchable                            |                                                                                                                                                                     |

|           |  |                      |                       |                   |                                                         |                                                |                                      |  |
|-----------|--|----------------------|-----------------------|-------------------|---------------------------------------------------------|------------------------------------------------|--------------------------------------|--|
| Statewide |  |                      | Black River West Fork | ONAP              | 20,000                                                  | May-September multiple times annually          | catchable                            |  |
| Statewide |  |                      | Crescent Lake         | ONMY              | 75,000                                                  | April-October multiple times annually          | fingerling, sub-catchable, catchable |  |
| Statewide |  |                      | Crescent Lake         | SAFO              | 35,000                                                  | April-October multiple times annually          | fingerling, sub-catchable, catchable |  |
| Statewide |  | Canyon Creek Complex | Canyon Creek          | ONMY              | 7,000                                                   | April-September multiple times annually        | fingerling, sub-catchable, catchable |  |
| Statewide |  |                      | Canyon Creek          | SATR              | 800                                                     | anytime to augment fishery/catastrophic events | sub-catchable                        |  |
| Statewide |  | Workman Creek        | Workman Creek         | ONMY              | 1,500                                                   | spring, summer (typically monthly stockings)   | sub-catchable, catchable             |  |
| Statewide |  | Tonto Creek Complex  | Tonto Creek           | ONMY              | 16,000                                                  | April-October multiple times annually          | catchable                            |  |
| Statewide |  |                      | Christopher Creek     | ONMY              | 10,000                                                  | April-October multiple times annually          | catchable                            |  |
| Statewide |  |                      | Haigler Creek         | ONMY              | 16,000                                                  | April-August multiple times annually           | catchable                            |  |
| Statewide |  | Lower Salt Complex   | Apache Lake           | ONMY              | 80,000                                                  | October-March multiple times annually          | sub-catchable, catchable             |  |
| Statewide |  |                      | Apache Lake           | SAVI              | 2.6 million x year (sac fry) 52,000 x year (fingerling) | anytime                                        | sac fry, fingerling                  |  |
| Statewide |  |                      | Apache Lake           | MIDO              | sport fish stocking protocol                            | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |  |
| Statewide |  |                      | Apache Lake           | MISA              | sport fish stocking protocol                            | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |  |
| Statewide |  |                      | Apache Lake           | <sup>1</sup> PONI | sport fish stocking protocol                            | anytime to augment fishery/catastrophic events | sub-catchable, catchable             |  |
| Statewide |  |                      | Apache Lake           | ICPU              | sport fish stocking protocol                            | anytime to augment fishery/catastrophic events | sub-catchable, catchable             |  |

|           |  |  |                     |                   |                                                            |                                                      |                                          |  |
|-----------|--|--|---------------------|-------------------|------------------------------------------------------------|------------------------------------------------------|------------------------------------------|--|
| Statewide |  |  | Canyon Lake         | ONMY              | 22,500                                                     | October-March<br>multiple times<br>annually          | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Canyon Lake         | SAVI              | 1 million x year (sac fry)<br>19,000 x year (fingerling)   | anytime                                              | sac fry, fingerling                      |  |
| Statewide |  |  | Canyon Lake         | ICPU              | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Canyon Lake         | MIDO              | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | fingerling, sub-<br>catchable, catchable |  |
| Statewide |  |  | Canyon Lake         | MISA              | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | fingerling, sub-<br>catchable, catchable |  |
| Statewide |  |  | Canyon Lake         | <sup>1</sup> PONI | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Saguaro Lake        | ONMY              | 13,000                                                     | October-March<br>multiple times<br>annually          | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Saguaro Lake        | SAVI              | 1.3 million x year (sac fry)<br>x year (fingerling) 26,000 | anytime                                              | sac fry, fingerling                      |  |
| Statewide |  |  | Saguaro Lake        | <sup>1</sup> MIDO | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | fingerling, sub-<br>catchable, catchable |  |
| Statewide |  |  | Saguaro Lake        | <sup>1</sup> PONI | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Saguaro Lake        | MISA              | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | fingerling, sub-<br>catchable, catchable |  |
| Statewide |  |  | Saguaro Lake        | ICPU              | sport fish stocking protocol                               | anytime to augment<br>fishery/catastrophic<br>events | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Tempe Town<br>Lake  | ONMY              | 45,000                                                     | November-April<br>multiple times<br>annually         | sub-catchable,<br>catchable              |  |
| Statewide |  |  | Salt River<br>Lower | ONMY              | 38,000                                                     | October-June multiple<br>times annually              | sub-catchable,<br>catchable              |  |

|       |  |               |                |                   |                                                             |                                        |                                      |  |
|-------|--|---------------|----------------|-------------------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  | Phoenix Metro | Alvord Lake    | ONMY              | 30,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Alvord Lake    | ICPU              | 30,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Alvord Lake    | LEMA              | 30,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Alvord Lake    | <sup>1</sup> LEMI | 30,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Alvord Lake    | MISA              | 3,000                                                       | multiple times annually                | sub-catchable, catchable             |  |
| Urban |  |               | Alvord Lake    | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |               | Alvord Lake    | <sup>1</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |               | Alvord Lake    | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |               | Chaparral Lake | ONMY              | 20,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Chaparral Lake | ICPU              | 20,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Chaparral Lake | LEMA              | 20,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Chaparral Lake | LEMI              | 20,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |               | Chaparral Lake | MISA              | 1,500                                                       | annually                               | sub-catchable, catchable             |  |
| Urban |  |               | Chaparral Lake | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |               | Chaparral Lake | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |               | Chaparral Lake | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |               | Cortez Lake    | ONMY              | 6,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |               | Cortez Lake    | ICPU              | 6,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |               | Cortez Lake    | LEMA              | 6,000                                                       | multiple times annually                | catchable                            |  |

|       |  |  |                    |      |                                                             |                                        |                                      |  |
|-------|--|--|--------------------|------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |  | Cortez Lake        | LEMI | 6,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Cortez Lake        | MISA | 500                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Cortez Lake        | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Cortez Lake        | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Cortez Lake        | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Desert Breeze Lake | ONMY | 8,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert Breeze Lake | ICPU | 8,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert Breeze Lake | LEMA | 8,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert Breeze Lake | LEMI | 8,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert Breeze Lake | MISA | 600                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Desert Breeze Lake | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Desert Breeze Lake | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Desert Breeze Lake | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Desert West Lake   | ONMY | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert West Lake   | ICPU | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert West Lake   | LEMA | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert West Lake   | LEMI | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Desert West Lake   | MISA | 800                                                         | annually                               | sub-catchable, catchable             |  |

|       |  |  |                     |      |                                                             |                                        |                                      |  |
|-------|--|--|---------------------|------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |  | Desert West Lake    | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Desert West Lake    | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Desert West Lake    | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Encanto Lake        | ONMY | 15,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Encanto Lake        | ICPU | 15,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Encanto Lake        | LEMA | 15,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Encanto Lake        | LEMI | 15,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Encanto Lake        | MISA | 1,100                                                       | multiple times annually                | sub-catchable, catchable             |  |
| Urban |  |  | Encanto Lake        | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Encanto Lake        | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Encanto Lake        | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Evelyn Hallman Pond | ONMY | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Evelyn Hallman Pond | ICPU | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Evelyn Hallman Pond | LEMA | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Evelyn Hallman Pond | LEMI | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Evelyn Hallman Pond | MISA | 500                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Evelyn Hallman Pond | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |

|       |  |  |                     |      |                                                             |                                            |                                          |  |
|-------|--|--|---------------------|------|-------------------------------------------------------------|--------------------------------------------|------------------------------------------|--|
| Urban |  |  | Evelyn Hallman Pond | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Evelyn Hallman Pond | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Kiwanis Lake        | ONMY | 25,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Kiwanis Lake        | ICPU | 25,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Kiwanis Lake        | LEMA | 25,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Kiwanis Lake        | LEMI | 25,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Kiwanis Lake        | MISA | 2,000                                                       | annually                                   | sub-catchable,<br>catchable              |  |
| Urban |  |  | Kiwanis Lake        | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Kiwanis Lake        | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Kiwanis Lake        | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Papago Ponds        | ONMY | 12,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Papago Ponds        | ICPU | 12,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Papago Ponds        | LEMA | 12,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Papago Ponds        | LEMI | 12,000                                                      | multiple times<br>annually                 | catchable                                |  |
| Urban |  |  | Papago Ponds        | MISA | 1,000                                                       | annually                                   | sub-catchable,<br>catchable              |  |
| Urban |  |  | Papago Ponds        | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Papago Ponds        | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| Urban |  |  | Papago Ponds        | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |

|       |  |  |                   |      |                                                             |                                        |                                      |  |
|-------|--|--|-------------------|------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |  | Red Mountain Lake | ONMY | 16,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Red Mountain Lake | ICPU | 16,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Red Mountain Lake | LEMA | 16,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Red Mountain Lake | LEMI | 16,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Red Mountain Lake | MISA | 1,200                                                       | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Red Mountain Lake | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Red Mountain Lake | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Red Mountain Lake | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Rio Vista Pond    | ONMY | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Rio Vista Pond    | ICPU | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Rio Vista Pond    | LEMA | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Rio Vista Pond    | LEMI | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Rio Vista Pond    | MISA | 500                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Rio Vista Pond    | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Rio Vista Pond    | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Rio Vista Pond    | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Riverview Lake    | ONMY | 7,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Riverview Lake    | ICPU | 7,000                                                       | multiple times annually                | catchable                            |  |



|       |  |  |                           |      |                                                             |                                        |                                      |  |
|-------|--|--|---------------------------|------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |  | Riverview Lake            | LEMA | 7,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Riverview Lake            | LEMI | 7,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Riverview Lake            | MISA | 600                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Riverview Lake            | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Riverview Lake            | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Riverview Lake            | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Steele Indian School Pond | ONMY | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Steele Indian School Pond | ICPU | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Steele Indian School Pond | LEMA | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Steele Indian School Pond | LEMI | 5,000                                                       | multiple times annually                | catchable                            |  |
| Urban |  |  | Steele Indian School Pond | MISA | 500                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Steele Indian School Pond | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Steele Indian School Pond | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Steele Indian School Pond | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Surprise Lake             | ONMY | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Surprise Lake             | ICPU | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Surprise Lake             | LEMA | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Surprise Lake             | LEMI | 10,000                                                      | multiple times annually                | catchable                            |  |

|       |  |  |                     |      |                                                             |                                        |                                      |  |
|-------|--|--|---------------------|------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |  | Surprise Lake       | MISA | 800                                                         | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Surprise Lake       | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Surprise Lake       | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Surprise Lake       | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Veterans Oasis Lake | ONMY | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Veterans Oasis Lake | ICPU | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Veterans Oasis Lake | LEMA | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Veterans Oasis Lake | LEMI | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Veterans Oasis Lake | MISA | 1,000                                                       | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Veterans Oasis Lake | LEMA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Veterans Oasis Lake | LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Veterans Oasis Lake | MISA | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Water Ranch Lake    | ONMY | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Water Ranch Lake    | ICPU | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Water Ranch Lake    | LEMA | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Water Ranch Lake    | LEMI | 10,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Water Ranch Lake    | MISA | 1,000                                                       | annually                               | sub-catchable, catchable             |  |

|       |  |                     |                  |                   |                                                             |                                        |                                      |  |
|-------|--|---------------------|------------------|-------------------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |                     | Water Ranch Lake | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |                     | Water Ranch Lake | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |                     | Water Ranch Lake | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN   |  | Special Urban Lakes | Crossroads Park  | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Crossroads Park  | <sup>2</sup> ICPU | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Crossroads Park  | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |
| FIN   |  |                     | Crossroads Park  | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Crossroads Park  | <sup>2</sup> LEMI | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Crossroads Park  | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN   |  |                     | Crossroads Park  | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN   |  |                     | Crossroads Park  | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN   |  |                     | Freestone Park   | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Freestone Park   | ICPU              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Freestone Park   | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |
| FIN   |  |                     | Freestone Park   | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Freestone Park   | <sup>2</sup> LEMI | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN   |  |                     | Freestone Park   | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |

|     |  |  |                |                   |                                                             |                                            |                                          |  |
|-----|--|--|----------------|-------------------|-------------------------------------------------------------|--------------------------------------------|------------------------------------------|--|
| FIN |  |  | Freestone Park | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Freestone Park | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | McQueen Park   | <sup>2</sup> ONMY | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | McQueen Park   | ICPU              | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | McQueen Park   | MISA              | 500                                                         | annually                                   | sub-catchable,<br>catchable              |  |
| FIN |  |  | McQueen Park   | LEMA              | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | McQueen Park   | <sup>2</sup> LEMI | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | McQueen Park   | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | McQueen Park   | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | McQueen Park   | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Bonsall Park   | <sup>2</sup> ONMY | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Bonsall Park   | ICPU              | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Bonsall Park   | MISA              | 500                                                         | annually                                   | sub-catchable,<br>catchable              |  |
| FIN |  |  | Bonsall Park   | LEMA              | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Bonsall Park   | <sup>2</sup> LEMI | 2,000                                                       | multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Bonsall Park   | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Bonsall Park   | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Bonsall Park   | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |

|     |  |  |                 |                   |                                                             |                                        |                                      |  |
|-----|--|--|-----------------|-------------------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| FIN |  |  | Pacana Park     | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Pacana Park     | ICPU              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Pacana Park     | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |
| FIN |  |  | Pacana Park     | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Pacana Park     | <sup>2</sup> LEMI | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Pacana Park     | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Pacana Park     | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Pacana Park     | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Granada Park    | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Granada Park    | ICPU              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Granada Park    | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |
| FIN |  |  | Granada Park    | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Granada Park    | LEMI              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Granada Park    | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Granada Park    | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Granada Park    | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Roadrunner Park | <sup>1</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Roadrunner Park | ICPU              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Roadrunner Park | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |

|     |  |  |                    |                   |                                                             |                                        |                                      |  |
|-----|--|--|--------------------|-------------------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| FIN |  |  | Roadrunner Park    | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Roadrunner Park    | LEMI              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Roadrunner Park    | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Roadrunner Park    | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Roadrunner Park    | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Eldorado Park      | <sup>2</sup> ONMY | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Eldorado Park      | ICPU              | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Eldorado Park      | MISA              | 500                                                         | Multiple times annually                | sub-catchable, catchable             |  |
| FIN |  |  | Eldorado Park      | LEMA              | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Eldorado Park      | LEMI              | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Eldorado Park      | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Eldorado Park      | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Eldorado Park      | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Indian School Park | <sup>2</sup> ONMY | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Indian School Park | ICPU              | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Indian School Park | MISA              | 500                                                         | Multiple times annually                | sub-catchable, catchable             |  |
| FIN |  |  | Indian School Park | LEMA              | 2,000                                                       | Multiple times annually                | catchable                            |  |
| FIN |  |  | Indian School Park | LEMI              | 2,000                                                       | Multiple times annually                | catchable                            |  |

|     |  |  |                       |                   |                                                             |                                            |                                          |  |
|-----|--|--|-----------------------|-------------------|-------------------------------------------------------------|--------------------------------------------|------------------------------------------|--|
| FIN |  |  | Indian School Park    | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Indian School Park    | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Indian School Park    | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Vista del Camino Park | <sup>2</sup> ONMY | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Vista del Camino Park | ICPU              | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Vista del Camino Park | MISA              | 500                                                         | Multiple times<br>annually                 | sub-catchable,<br>catchable              |  |
| FIN |  |  | Vista del Camino Park | LEMA              | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Vista del Camino Park | LEMI              | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Vista del Camino Park | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Vista del Camino Park | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Vista del Camino Park | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/<br>catastrophic events | fingerling, sub-<br>catchable, catchable |  |
| FIN |  |  | Tempe Papago Park     | <sup>2</sup> ONMY | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Tempe Papago Park     | ICPU              | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Tempe Papago Park     | MISA              | 500                                                         | Multiple times<br>annually                 | sub-catchable,<br>catchable              |  |
| FIN |  |  | Tempe Papago Park     | LEMA              | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |
| FIN |  |  | Tempe Papago Park     | LEMI              | 2,000                                                       | Multiple times<br>annually                 | catchable                                |  |

|     |  |  |                         |                   |                                                             |                                        |                                      |  |
|-----|--|--|-------------------------|-------------------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| FIN |  |  | Tempe Papago Park       | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Tempe Papago Park       | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Tempe Papago Park       | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Water Treatment         | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Water Treatment         | <sup>2</sup> ICPU | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Water Treatment         | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |
| FIN |  |  | Water Treatment         | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Water Treatment         | <sup>2</sup> LEMI | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Water Treatment         | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Water Treatment         | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Water Treatment         | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| FIN |  |  | Discovery District Park | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Discovery District Park | <sup>2</sup> ICPU | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Discovery District Park | MISA              | 500                                                         | annually                               | sub-catchable, catchable             |  |
| FIN |  |  | Discovery District Park | LEMA              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Discovery District Park | LEMI              | 2,000                                                       | multiple times annually                | catchable                            |  |
| FIN |  |  | Discovery District Park | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime augment/catastrophic events    | fingerling, sub-catchable, catchable |  |



|           |                  |                  |                         |                   |                                                             |                                                |                                      |  |
|-----------|------------------|------------------|-------------------------|-------------------|-------------------------------------------------------------|------------------------------------------------|--------------------------------------|--|
| FIN       |                  |                  | Discovery District Park | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime augment/catastrophic events            | fingerling, sub-catchable, catchable |  |
| FIN       |                  |                  | Discovery District Park | LEMI              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime augment/catastrophic events            | fingerling, sub-catchable, catchable |  |
| FIN       |                  |                  | Selleh Park             | <sup>2</sup> ONMY | 2,000                                                       | multiple times annually                        | catchable                            |  |
| FIN       |                  |                  | Selleh Park             | ICPU              | 2,000                                                       | multiple times annually                        | catchable                            |  |
| FIN       |                  |                  | Selleh Park             | MISA              | 500                                                         | annually                                       | sub-catchable, catchable             |  |
| FIN       |                  |                  | Selleh Park             | LEMA              | 2,000                                                       | multiple times annually                        | catchable                            |  |
| FIN       |                  |                  | Selleh Park             | <sup>2</sup> LEMI | 2,000                                                       | multiple times annually                        | catchable                            |  |
| FIN       |                  |                  | Selleh Park             | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime augment/catastrophic events            | fingerling, sub-catchable, catchable |  |
| FIN       |                  |                  | Selleh Park             | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime augment/catastrophic events            | fingerling, sub-catchable, catchable |  |
| FIN       |                  |                  | Selleh Park             | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime augment/catastrophic events            | fingerling, sub-catchable, catchable |  |
| Statewide | Santa Cruz River | Upper Santa Cruz | Parker Canyon           | ONMY              | 45000                                                       | October-April multiple times annually          | catchable                            |  |
| Statewide |                  |                  | Parker Canyon           | ICPU              | sport fish stocking protocol                                | anytime to augment fishery/catastrophic events | sub-catchable, catchable             |  |
| Statewide |                  |                  | Parker Canyon           | LEMI              | sport fish stocking protocol                                | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |  |
| Statewide |                  |                  | Parker Canyon           | LEMA              | sport fish stocking protocol                                | anytime to augment fishery/catastrophic events | fingerling, sub-catchable, catchable |  |
| Statewide |                  |                  | Patagonia               | ONMY              | 30,000                                                      | November-March multiple times annually         | catchable                            |  |
| Statewide |                  |                  | Pena Blanca             | ONMY              | 45,000                                                      | November-March multiple times annually         | catchable                            |  |

|           |  |                           |                |                   |                                                             |                                              |                                      |                                                                                     |
|-----------|--|---------------------------|----------------|-------------------|-------------------------------------------------------------|----------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------|
| Statewide |  | Middle Santa Cruz         | Rose Canyon    | ONMY              | 30,000                                                      | April-late September multiple times annually | catchable                            | This lake would be stocked multiple times annually based on water level and quality |
| Statewide |  |                           | Rose Canyon    | SATR              | 10,000(sub-catchable) 20,000 (catchable)                    | multiple times annually                      | sub-catchable, catchable             |                                                                                     |
| Urban     |  | Tucson Santa Cruz complex | Sahuarita Lake | ONMY              | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | ICPU              | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | LEMA              | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | <sup>2</sup> LEMI | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | MISA              | 1,500                                                       | annually                                     | sub-catchable, catchable             |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/ catastrophic events      | fingerling, sub-catchable, catchable |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/ catastrophic events      | fingerling, sub-catchable, catchable |                                                                                     |
| Urban     |  |                           | Sahuarita Lake | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/ catastrophic events      | fingerling, sub-catchable, catchable |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | ONMY              | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | ICPU              | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | LEMA              | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | <sup>2</sup> LEMI | 20,000                                                      | multiple times annually                      | catchable                            |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | MISA              | 1,500                                                       | annually                                     | sub-catchable, catchable             |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/ catastrophic events      | fingerling, sub-catchable, catchable |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/ catastrophic events      | fingerling, sub-catchable, catchable |                                                                                     |
| Urban     |  |                           | Kennedy Lake   | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/ catastrophic events      | fingerling, sub-catchable, catchable |                                                                                     |

|       |  |  |                                   |                   |                                                             |                                        |                                      |  |
|-------|--|--|-----------------------------------|-------------------|-------------------------------------------------------------|----------------------------------------|--------------------------------------|--|
| Urban |  |  | Lakeside Lake                     | ONMY              | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Lakeside Lake                     | ICPU              | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Lakeside Lake                     | LEMA              | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Lakeside Lake                     | <sup>2</sup> LEMI | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Lakeside Lake                     | MISA              | 2,000                                                       | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Lakeside Lake                     | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Lakeside Lake                     | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Lakeside Lake                     | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | ONMY              | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | ICPU              | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | LEMA              | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | <sup>2</sup> LEMI | 25,000                                                      | multiple times annually                | catchable                            |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | MISA              | 2,000                                                       | annually                               | sub-catchable, catchable             |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | LEMA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Urban |  |  | Silverbell Lake (and Archer Pond) | MISA              | Urban Fishing Start-Up and Augmentation Stocking Guidelines | anytime to augment/catastrophic events | fingerling, sub-catchable, catchable |  |

|           |                    |                                |                                      |                   |                                                                |                                                     |                                          |  |
|-----------|--------------------|--------------------------------|--------------------------------------|-------------------|----------------------------------------------------------------|-----------------------------------------------------|------------------------------------------|--|
| Urban     |                    |                                | Silverbell Lake<br>(and Archer Pond) | PONI              | Urban Fishing Start-Up and Augmentation<br>Stocking Guidelines | anytime to augment/<br>catastrophic events          | sub-catchable,<br>catchable              |  |
| FIN       |                    |                                | Reid Park                            | <sup>2</sup> ONMY | 2,000                                                          | annually                                            | catchable                                |  |
| FIN       |                    |                                | Reid Park                            | ICPU              | 2,000                                                          | annually                                            | catchable                                |  |
| FIN       |                    |                                | Reid Park                            | MISA              | 500                                                            | annually                                            | sub-catchable,<br>catchable              |  |
| FIN       |                    |                                | Reid Park                            | LEMA              | 2,000                                                          | annually                                            | catchable                                |  |
| FIN       |                    |                                | Reid Park                            | <sup>2</sup> LEMI | 2,000                                                          | annually                                            | catchable                                |  |
| FIN       |                    |                                | Reid Park                            | MISA              | Urban Fishing Start-Up and Augmentation<br>Stocking Guidelines | anytime to augment/<br>catastrophic events          | fingerling, sub-<br>catchable, catchable |  |
| FIN       |                    |                                | Reid Park                            | LEMA              | Urban Fishing Start-Up and Augmentation<br>Stocking Guidelines | anytime to augment/<br>catastrophic events          | fingerling, sub-<br>catchable, catchable |  |
| FIN       |                    |                                | Reid Park                            | <sup>2</sup> LEMI | Urban Fishing Start-Up and Augmentation<br>Stocking Guidelines | anytime to augment/<br>catastrophic events          | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                    | Pantano Wash-<br>Rillito River | Arivaca                              | <sup>1</sup> ICPU | sport fish stocking protocol                                   | anytime to augment/<br>catastrophic event           | sub-catchable,<br>catchable              |  |
| Statewide |                    |                                | Arivaca                              | LEMI              | sport fish stocking protocol                                   | anytime to augment/<br>catastrophic event           | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                    |                                | Arivaca                              | LEMA              | sport fish stocking protocol                                   | anytime to augment/<br>catastrophic event           | fingerling, sub-<br>catchable, catchable |  |
| Statewide | <b>Verde River</b> | Big Chino Wash<br>Complex      | Granite Basin Lake                   | MISA              | 1,000xacre(fingerling)100xacre(catchable)                      | spring, summer, fall<br>augment/catastrophic events | fingerling, catchable                    |  |
| Statewide |                    |                                | Granite Basin Lake                   | LEMA              | 1,000xacre(fingerling)100xacre(catchable)                      | spring, summer, fall<br>augment/catastrophic events | fingerling, catchable                    |  |
| Statewide |                    |                                | Garrett Tank                         | ICPU              | 100xacre                                                       | May-August (2x<br>annually)                         | catchable                                |  |
| Statewide |                    |                                | Garrett Tank                         | <sup>1</sup> ONMY | 100xacre                                                       | December-March (2x<br>annually)                     | catchable                                |  |
| Statewide |                    |                                | Garrett Tank                         | <sup>2</sup> PONI | 500xacre(fingerling)50xacre(catchable)                         | spring, summer, fall                                | fingerling, catchable                    |  |
| Statewide |                    |                                | Garrett Tank                         | LEMA              | 500xacre(fingerling)50xacre(catchable)                         | spring, summer, fall                                | fingerling, catchable                    |  |

|           |  |                  |               |                   |                                        |                                                  |                                      |  |
|-----------|--|------------------|---------------|-------------------|----------------------------------------|--------------------------------------------------|--------------------------------------|--|
| Statewide |  |                  | Stone Dam     | ICPU              | 1,500                                  | April-July                                       | catchable                            |  |
| Statewide |  |                  | Stone Dam     | ICPU              | sport fish stocking protocol           | spring, summer, fall augment/catastrophic events | fingerling, sub-catchable            |  |
| Statewide |  |                  | Stone Dam     | LEMA              | sport fish stocking protocol           | spring, summer, fall augment/catastrophic events | fingerling, sub-catchable            |  |
| Statewide |  |                  | Stone Dam     | MISA              | sport fish stocking protocol           | spring, summer, fall augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Statewide |  |                  | Stone Dam     | <sup>2</sup> LEMI | sport fish stocking protocol           | spring, summer, fall augment/catastrophic events | fingerling, sub-catchable, catchable |  |
| Statewide |  |                  | Shucking Tank | <sup>1</sup> MISA | 500xacre(fingerling)50xacre(catchable) | spring, summer, fall augment/catastrophic events | fingerling, catchable                |  |
| Statewide |  |                  | Shucking Tank | <sup>1</sup> LEMA | 500xacre(fingerling)50xacre(catchable) | spring, summer, fall augment/catastrophic events | fingerling, catchable                |  |
| Statewide |  |                  | Shucking Tank | <sup>1</sup> ICPU | 100xacre                               | May-August (2x annually)                         | catchable                            |  |
| Statewide |  |                  | Shucking Tank | <sup>2</sup> ONMY | 100xacre                               | December-March (2x annually)                     | catchable                            |  |
| Statewide |  |                  | Shucking Tank | <sup>2</sup> PONI | 500xacre(fingerling)50xacre(catchable) | spring, summer, fall augment/catastrophic events | fingerling, catchable                |  |
| Statewide |  |                  | Presley Tank  | <sup>1</sup> MISA | 500xacre(fingerling)50xacre(catchable) | spring, summer, fall augment/catastrophic events | fingerling, catchable                |  |
| Statewide |  |                  | Presley Tank  | LEMA              | 500xacre(fingerling)50xacre(catchable) | spring, summer, fall augment/catastrophic events | fingerling, catchable                |  |
| Statewide |  |                  | Presley Tank  | <sup>1</sup> ICPU | 100xacre                               | summer (2x annually)                             | catchable                            |  |
| Statewide |  |                  | Presley Tank  | <sup>2</sup> ONMY | 100xacre                               | winter (2x annually)                             | catchable                            |  |
| Statewide |  |                  | Presley Tank  | <sup>2</sup> PONI | 500xacre(fingerling)50xacre(catchable) | spring, summer, fall augment/catastrophic events | fingerling, catchable                |  |
| Statewide |  | Sycamore Complex | Elk Tank      | ONMY              | 3,000                                  | March-November multiple times annually           | sub-catchable, catchable             |  |

|           |  |                      |                  |                   |                              |                                                               |                                      |                                                                             |
|-----------|--|----------------------|------------------|-------------------|------------------------------|---------------------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------|
| Statewide |  |                      | Elk Tank         | <sup>2</sup> SATR | 750                          | September-November                                            | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | JD Dam           | ONMY              | 14,000                       | March-November multiple times annually                        | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | JD Dam           | <sup>1</sup> SATR | 1,500                        | September-November multiple times annually                    | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | White Horse Lake | ONMY              | 53,000                       | spring, summer, fall multiple times annually                  | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | White Horse Lake | <sup>1</sup> SATR | 20,000                       | fall multiple times annually                                  | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | Middle Tank      | ONMY              | 3,000                        | March-November multiple times annually                        | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | Middle Tank      | <sup>1</sup> SATR | 750                          | September-November                                            | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | Perkins Tank     | ONMY              | 3,000                        | March-November multiple times annually                        | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | Perkins Tank     | <sup>1</sup> SATR | 750                          | September-November                                            | sub-catchable, catchable             |                                                                             |
| Statewide |  |                      | Perkins Tank     | SAFO              | 1,000                        | March-June (opportunistically when available from hatcheries) | fingerling, sub-catchable            |                                                                             |
| Statewide |  |                      | Perkins Tank     | THAR              | 1,000                        | March-June (opportunistically when available from hatcheries) | sub-catchable, catchable             |                                                                             |
| Statewide |  | Middle Verde Complex | Mingus Lake      | ONMY              | 10,500                       | April-October multiple times annually                         | catchable                            |                                                                             |
| Statewide |  |                      | Mingus Lake      | <sup>2</sup> LEMA | sport fish stocking protocol | spring, summer, fall augment/catastrophic events              | fingerling, sub-catchable, catchable |                                                                             |
| Statewide |  |                      | Mingus Lake      | <sup>2</sup> PONI | sport fish stocking protocol | spring, summer, fall augment/catastrophic events              | fingerling, sub-catchable, catchable |                                                                             |
| Statewide |  |                      | Dead Horse Lake  | ONMY              | 300,000                      | January-March, November-December multiple times annually      | fingerling, sub-catchable, catchable | Numbers of fish planned to be stocked is the total number for all 3 lagoons |

|           |  |                       |                    |                   |                                      |                                                     |                                      |                                                                                                       |
|-----------|--|-----------------------|--------------------|-------------------|--------------------------------------|-----------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------|
| Statewide |  |                       | Dead Horse Lake    | <sup>2</sup> DOPE | 10,000                               | anytime augment fishery/catastrophic event          | any size                             | Numbers of fish planned to be stocked is the total number for all 3 lagoons for each species of fish. |
| Statewide |  |                       | Dead Horse Lake    | ICPU              | sport fish stocking protocol         | anytime augment fishery/catastrophic event          | sub-catchable, catchable             |                                                                                                       |
| Statewide |  |                       | Dead Horse Lake    | LEMA              | sport fish stocking protocol         | anytime augment fishery/catastrophic event          | sub-catchable, catchable             |                                                                                                       |
| Statewide |  |                       | Dead Horse Lake    | MISA              | sport fish stocking protocol         | anytime augment fishery/catastrophic event          | fingerling, sub-catchable, catchable |                                                                                                       |
| Statewide |  |                       | Dead Horse Lake    | PONI              | sport fish stocking protocol         | anytime augment fishery/catastrophic event          | sub-catchable, catchable             |                                                                                                       |
| Statewide |  |                       | Verde River Middle | ONMY              | 30,000                               | November-March multiple times annually              | catchable                            | fish distributed between 5 stocking sites                                                             |
| Statewide |  |                       | Oak Creek          | ONMY              | 60,000                               | March-November multiple times annually              | catchable                            |                                                                                                       |
| Statewide |  |                       | Wet Beaver Creek   | ONMY              | 6,000                                | March-May, October-November multiple times annually | catchable                            |                                                                                                       |
| Statewide |  |                       | West Clear Creek   | ONMY              | 6,000                                | March-May, October-November multiple times annually | catchable                            |                                                                                                       |
| Statewide |  |                       | Huffer Lake        | ONMY              | 4,000                                | April-October multiple times annually               | catchable                            |                                                                                                       |
| Statewide |  | Granite Creek Complex | Watson Lake        | <sup>1</sup> ONMY | 15,000                               | November-March multiple times annually              | catchable                            |                                                                                                       |
| Statewide |  |                       | Watson Lake        | PONI              | 200,000(fingerling) 2,000(catchable) | anytime to augment fishery/catastrophic event       | fingerling, catchable                |                                                                                                       |
| Statewide |  |                       | Watson Lake        | LEMA              | 200,000(fingerling) 2,000(catchable) | anytime to augment fishery/catastrophic event       | fingerling, catchable                |                                                                                                       |
| Statewide |  |                       | Goldwater Lake     | MISA              | 50xacre                              | spring                                              | sub-catchables, catchables           |                                                                                                       |

|           |                                    |                                    |                           |                   |                                      |                                                     |                                          |  |
|-----------|------------------------------------|------------------------------------|---------------------------|-------------------|--------------------------------------|-----------------------------------------------------|------------------------------------------|--|
| Statewide |                                    |                                    | Goldwater Lake            | <sup>1</sup> PONI | 100xacre                             | summer                                              | catchable                                |  |
| Statewide |                                    |                                    | Goldwater Lake            | LEMA              | 100xacre                             | summer                                              | catchable                                |  |
| Statewide |                                    |                                    | Goldwater Lake            | ONMY              | 400xacre                             | February-November<br>(bi-monthly)                   | catchable                                |  |
| Statewide |                                    |                                    | Willow Creek<br>Reservoir | <sup>1</sup> PONI | 200,000(fingerling) 2,000(catchable) | anytime to augment<br>fishery/catastrophic<br>event | fingerling, catchable                    |  |
| Statewide |                                    |                                    | Willow Creek<br>Reservoir | LEMA              | 200,000(fingerling) 2,000(catchable) | anytime to augment<br>fishery/catastrophic<br>event | fingerling, catchable                    |  |
| Statewide |                                    |                                    | Willow Creek<br>Reservoir | <sup>1</sup> ONMY | 15,000                               | November-March<br>multiple times<br>annually        | catchable                                |  |
| Statewide |                                    | Lower<br>Verde<br>River<br>Complex | East Verde<br>River       | ONMY              | 32,000                               | April-August multiple<br>times annually             | sub-catchable,<br>catchable              |  |
| Urban     |                                    |                                    | Green Valley<br>Lake      | ONMY              | 15,000                               | October-May multiple<br>times annually              | catchable                                |  |
| Statewide | <b>Bill<br/>Williams<br/>River</b> | Santa<br>Maria<br>complex          | Granite<br>Mountain #1    | <sup>1</sup> LEMA | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                                    |                                    | Granite<br>Mountain #1    | <sup>2</sup> LEMI | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                                    |                                    | Granite<br>Mountain #2    | <sup>1</sup> LEMA | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                                    |                                    | Granite<br>Mountain #2    | <sup>2</sup> LEMI | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                                    |                                    | Bass Tank                 | LEMA              | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                                    |                                    | Bass Tank                 | <sup>2</sup> LEMI | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |
| Statewide |                                    |                                    | Blue Tank                 | LEMA              | sport fish stocking protocol         | anytime augment<br>fishery/catastrophic<br>event    | fingerling, sub-<br>catchable, catchable |  |



|           |  |                     |               |                   |                              |                                            |                                      |                                                              |
|-----------|--|---------------------|---------------|-------------------|------------------------------|--------------------------------------------|--------------------------------------|--------------------------------------------------------------|
| Statewide |  |                     | Blue Tank     | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable |                                                              |
| Statewide |  | Burro Creek Complex | Carter Tank   | LEMA              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable |                                                              |
| Statewide |  |                     | Carter Tank   | LEMI              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable |                                                              |
| Statewide |  |                     | Coor's Lake   | <sup>1</sup> ICPU | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Coor's Lake   | MISA              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Coor's Lake   | PONI              | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Coor's Lake   | LEMA              | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Coor's Lake   | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Antelope Tank | <sup>1</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Antelope Tank | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Bar 37 Tank   | <sup>1</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Bar 37 Tank   | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |                     | Harman Tank   | LEMA              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable | stocking periodically for maintenance of self sustaining pop |

|           |  |  |                      |                   |                              |                                            |                                      |                                                              |
|-----------|--|--|----------------------|-------------------|------------------------------|--------------------------------------------|--------------------------------------|--------------------------------------------------------------|
| Statewide |  |  | Harman Tank          | LEMI              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Harmon Tank 2        | <sup>1</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Harmon Tank 2        | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Little Antelope Tank | <sup>1</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Little Antelope Tank | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | McElhaneey Tank      | <sup>1</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | McElhaneey Tank      | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Stubb's Tank         | <sup>1</sup> LEMA | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Stubb's Tank         | <sup>2</sup> LEMI | sport fish stocking protocol | anytime augment fishery/catastrophic event | sub-catchable, catchable             | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Swale                | LEMA              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable | stocking periodically for maintenance of self sustaining pop |
| Statewide |  |  | Swale                | LEMI              | sport fish stocking protocol | anytime augment fishery/catastrophic event | fingerling, sub-catchable, catchable | stocking periodically for maintenance of self sustaining pop |

|      |                                                                                                       |
|------|-------------------------------------------------------------------------------------------------------|
| KEY: | <b>New sites and/or changes in species proposed</b>                                                   |
|      | <sup>1</sup> denotes proposed species historically present; unknown if still in present in water body |
|      | <sup>2</sup> denotes proposed species not known to be present historically or currently in water body |

## Species Code Key

| Code | Common Name      | Code | Common Name     | Code | Common Name     |
|------|------------------|------|-----------------|------|-----------------|
| CTID | White Amur       | ONAP | Apache Trout    | SAFO | Brook Trout     |
| DOPE | Threadfin Shad   | ONCL | Cutthroat Trout | SATR | Brown Trout     |
| ICPU | Channel Catfish  | ONGI | Gila Trout      | SAVI | Walleye         |
| LEMA | Bluegill Sunfish | ONMY | Rainbow Trout   | THAR | Arctic Grayling |
| LEMI | Redear Sunfish   | PEFL | Yellow Perch    |      |                 |
| MIDO | Smallmouth bass  | POAN | White Crappie   |      |                 |
| MISA | Largemouth Bass  | PONI | Black Crappie   |      |                 |

## **Appendix D**

### **Disease transmission analysis and Fish, Leopard Frog and Gartersnake Interactions (From BA)**

**Note: The following two chapters from the BA have been slightly modified (updates to some references and some deletions where citation could not be verified) from that appearing in the draft BA. The essential features of the information presented have not changed.**

## **Chapter 3 Analysis Methods and Criteria**

### **Introduction to Methods**

Locations proposed for stocking across the state were identified and arranged by major watershed. The watersheds were then divided into sub watersheds for further evaluation of hydrologic connections associated with the stocking sites and instream and/or downstream species.

### **Structure for Assessment**

The goal of this assessment document is to review and evaluate potential impacts of proposed stocking activities for ten years on any listed, candidate, proposed species and/or critical habitats not addressed through previous assessment and/or consultation efforts. The document incorporates the required information as outlined in the Federal Aid Section 7 Biological Evaluation Form, guidance from the Federal Aid Toolkit and Section 7 Consultation Handbook. For each species, we provide background information, biology, life history, watershed by watershed distribution, direct and indirect effects of the proposed action and an assessment of other effects for those stocking sites where there may be impacts to the species. Further, we identify regulations and fish stocking procedures undertaken by AGFD designed to ensure responsible stocking practices thereby minimizing, reducing or eliminating disease transmission through stocking of fish and unauthorized transportation and release of stocked fish and associated bait (fish, waterdogs, and crayfish) (regulations were identified in Chapter 1). Interdependent, interrelated actions and/or cumulative effects (non-federal fish stocking or riparian projects) of the proposed stocking actions to listed, candidate, proposed species and/or critical habitat are broadly identified and defined within Chapter 4.

### **Watershed Analysis of hydrologic Connectivity**

Information guiding this analysis included the descriptions of the watershed, subwatershed and each stocking site. The stocking sites included specific information as to the waterbody, recreational management of the area, existing conditions, management of the waterbody, proposed action and potential impact analysis. The potential impact analysis was extended to a complex level (grouping of sites where appropriate) depending on hydrologic connection and/or stream connections. Complete descriptions of all stocking sites, their history, connectivity and the local conditions are provided in the watershed chapters (Chapters 5-10).

### **Species and Critical Habitat Evaluated**

Primary sources of listed, candidate, proposed species and/or critical habitats distribution include AGFD's Heritage Data Management System (HDMS), the Nongame and Endangered Wildlife Program's Native Fish Database, AGFD Riparian Herpetofauna database, and Willow Flycatcher Database. The HDMS is part of a global network including over 80 natural heritage programs and conservation data centers. The information comes from published and unpublished reports, data collected by cooperating agencies, museum and herbarium collections, the scientific and academic communities, Federal Register, and many other sources.

The list of species assessed and reviewed through this assessment process includes all listed or proposed species, proposed or designated critical habitat and candidate species associated with aquatic, wetland and/or riparian habitats where sport fish would be stocked or anglers would access in pursuit of stocked sport fish. Analyses of two additional species that are most likely to become listed in the next ten years were also included.

A spatial approach to the analysis was utilized to identify and map species and/or critical habitats in relation to the proposed stocking locations. The multi-step process to develop this spatial representation (maps) included: proximity of stocking locations to habitats occupied (or historical localities) by species and/or critical habitats. Data from numerous sources were incorporated into ArcGIS for use in spatial analysis and included the best information available to AGFD. The HDMS point data is based on representation of occupied areas of breeding populations with a 1-mile buffer around the point (species) for the protection of the exact location. The state was then broken into watershed units using the US Geological Survey Hydrologic Unit Codes (HUCs) at the HUC 6 level and then further divided into subwatersheds at the HUC 8 level.

Recreational angling impacts are limited to the water's edge or within a reasonable distance from a water source (travel to the water source). This area is referred to as the **stocking area**. Where there is connectivity between stocking locations and waters supporting listed/proposed/candidate species and/or critical habitat, effects from the stocking location may extend further along those waterway connections. This area is referred to as the **connected area**. These areas of potential impact to listed/proposed/candidate species and/or critical habitat by the proposed activities or associated recreational activities are referred to as the **action area**. A GIS product was developed as the framework for the analysis.

The analysis then proceeded species by species within each watershed. The primary analysis tool for the assessment was based on the working maps developed as described above with review from the AGFD Regional Fisheries and Nongame species leads. The review process included AGFD, WSFR and USFWS Ecological Services personnel.

General preliminary criteria questions were developed for taxonomic groups to establish links between the action and potential listed taxons. The first criteria established the geographic link and included connectivity, probability of movement and suitability of habitat (e.g. potential for stocked fish to survive in the habitat it moved to). The second criteria established the link biologically through interactions between stocked fish and listed, proposed or candidate species (competition, predation, reproduction, disease, angler access) and impact to critical habitat, where appropriate.

According to USFWS [50 CFR 402.12(g)], it is the responsibility of WSFR to evaluate all potential impacts of funding sport fish stocking activities to all identified listed, candidate, proposed species and/or critical habitat. Species identified by the USFWS as candidates for listing are evaluated based on a standard of "likely or not likely to jeopardize" under provisions for conferences.

Listed, candidate, proposed species and/or their critical habitats are assessed in detail within this document. The review process includes review and assessment with regard to the general analysis criteria as listed above.

### **Species Interaction Approach**

In order to determine the nature of the exposure between stocked sport fish and listed species of concern, it was necessary to consider the biology of each species stocked and the nature of the response or interaction with each of the listed species. Consideration of this biological interaction resulted in the following descriptions, arranged by general taxonomic groupings for the listed species.

#### ***Fish Interactions Background Information***

##### **Apache Trout**

##### **Methods & Criteria**

Impacts to Apache trout and Gila trout require a unique evaluation because these species are currently listed as threatened under the Endangered Species Act with a special (4(d)) rule that provides for angling of the species as long as the angling comports with the laws of the state of Arizona. The proposed action includes stocking Apache trout and Gila trout for the purpose of furthering the conservation of the species through supporting angling opportunity for the species. The following methods were also used to define effects for Gila trout.

Currently conservation and/or recovery of the species in Arizona include several management actions. These include designating and managing recovery populations which are primarily located above constructed or natural barriers. Another management strategy is to promote conservation of Apache trout by actively stocking Apache trout for the purpose of angling with anticipated harvest of the stocked individuals as provided by the ESA 4(d) special rule. In some cases other sport fish species are stocked with Apache trout, and/or stocked Apache trout may impact other listed species. As such, there is a need to evaluate potential impacts to the species given several scenarios. These include:

1. Impacts from sport fish species co-stocked with Apache trout in non-recovery areas for the intent of providing angling opportunity.
2. Impacts from stocked sport fish species to recovery Apache trout that escape from recovery areas above barriers.
3. Impacts from stocked sport fish species to recovery Apache trout if those stocked species move above a failed barrier or into recovery reaches
4. Impacts from Apache trout stocked into recovery Apache trout populations with the intent that the entire population be fishable by the public (this only occurs in 1 case).
5. Impacts from stocked Apache trout on other candidate or listed species and critical habitat.
6. Impacts on stocked Apache trout from wild fish populations present in the receiving waters.

The analysis approach was informed and developed in the following manner:

- Reviewing the down listing packages for Apache and Gila Trout, both of which have been down listed from Endangered to Threatened, are managed as sport fish in the State of Arizona, and have a 4(d) special rule.
- Identifying possible scenarios that could result in impacts to Apache trout.
- Reviewing the applicability of Section 6 of the Endangered Species act, the Apache trout 4(d) special rule and 10(a)(1)(a) permit.
- Developing an impact analysis for each of the scenarios identified above and applying them to applicable stocking reaches or complexes.

In evaluating impacts to Apache trout, two separate proposed actions are considered, first the action of stocking nonnative sport fish (rainbow trout, brook trout, arctic grayling, etc.), and second, the action of stocking native Apache trout into non-recovery streams or waters to provide angling opportunity. The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. The States have specific authority for management of endangered species, in part, manifested through State Section 6 Cooperative Agreements, which authorize management activities for threatened and endangered species. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD. Because stocking of Apache trout is for conservation purposes and consistent with the Act and the Cooperative agreement, take of Apache trout from the proposed stocking of Apache trout is legally permitted. The action of stocking all other nonnative sport fish and potential effects to Apache trout, impacts from stocked Apache trout on other listed species, and any impacts to critical habitat are analyzed under Section 7 of the Act. Under the ESA, Apache trout hybrids are not protected as a threatened species (USFWS 2008a) and impacts to hybrid Apache trout are therefore not evaluated.

### *Riparian Reptiles and Amphibians Methodology*

#### *Batrachochytrium dendrobatidis and the spread of Amphibian Chytridiomycosis*

The following review and information were prepared to provide an understanding of basic biology, transport mechanisms and impacts to amphibians in Arizona of the amphibian fungal pathogen, *Batrachochytrium dendrobatidis* (sometimes referred to as “chytrid” and hereafter as “*Bd*”), and to use that information to evaluate current hatchery operations and the likelihood of spread of *Bd* through fish stocking. This is not meant to be an exhaustive review of the global literature on *Bd* or chytridiomycosis, instead this will concentrate on those aspects of the biology of the organism that are relevant to its survival and distribution in Arizona, and how those might affect the (AGFD) hatchery operations related to the statewide sport fish stocking program.

#### **Introduction and Basic Biology of *Bd***

Fungi in the primitive group Chytridiomycota are characterized by unflagellated reproductive cells, and typically occur in water or moist soils, where they are parasites of protists, other fungi, algae, plants, insects and other invertebrates, as well as biodegraders of plant and animal remains containing cellulose, chitin or keratin (Powell 1993). Only one species, *Bd*, is known to infect



vertebrates, and prior to 1998 it was unknown to science (Berger et al. 1998, Longcore et al. 1999). *Bd* causes the serious and sometimes virulent amphibian disease chytridiomycosis (Berger et al. 1998, Longcore et al. 1999, Stuart et al. 2004). In the last decade, the role of infectious diseases has been recognized as a key factor in amphibian declines throughout the world, and chytridiomycosis has been linked too much of that decline (Daszak et al. 1999, Carey 2000, Collins and Storfer 2003, Daszak et al. 2003, Skerratt et al. 2007). Recent studies support the contention that *Bd* is an emerging infectious disease, i.e., a novel pathogen (Vredenburg et al. 2010), and not a widespread endemic that has emerged as a result of environmental change (e.g., Pounds et al. 2006).

Although many other chytrid species have been well studied as parasites of economically important plants (Powell 1993), surprisingly few studies have investigated the basic biology or ecology of *Bd*, although significant advances continue to be made (e.g., Woodhams et al. 2008, Voyles et al. 2009, Briggs et al. 2010, Vredenburg et al. 2010).

*Bd* has a complex life cycle in which “infective,” free-living motile zoospores encounter, and encyst on the keratinized epidermis of amphibians and then develop into reproductive sporangia (zoosporangia) which produce more zoospores through asexual reproduction. The zoospores are then released back into the water through a discharge tube and the cycle continues; no resting spores have been identified in laboratory studies (Longcore et al. 1999). Amphibians (frogs and salamanders) are the only known hosts for *Bd*; *Bd* has not been reported in caecilians (Gower and Wilkinson 2005).

There are few data regarding the ability of *Bd* to occupy alternative hosts (i.e., other than amphibians). Although *Bd* had been reported from freshwater shrimp in Australia (Rowley and Alford 2006), subsequent work by the same research group falsified their original findings (Rowley et al. 2007). Collins et al. (2005) used PCR to test for the presence of *Bd* on a variety of plants and animals collected from sites from which *Bd* was already known. They reported a *Bd* positive result from a batch sample of 6 wild caught fathead minnows (*Pimephales promelas*) from Sycamore Creek, Maricopa County, AZ. Whether one or more of those fish was infected with *Bd*, or simply had zoosporangia or zoospores (or their remains) on the surface of their fins is not known. They also exposed several potential host animals to large quantities of *Bd* zoospores in a series of experiments. Results suggested that backswimmers (Notonectidae, *Notonecta* sp.), dragonfly naiads (Odonata, including individuals in families Aeshnidae and Libellulidae) and crayfish (*Orconectes virilis*) were capable of carrying *Bd* for several days. Sample sizes in all cases were small and experimental procedures varied considerably (including different species of odonates). Although the authors used terms like “infected” to describe the results, the results were only *Bd* positive, suggesting that at a minimum zoospores or zoosporangia persisted on an organisms’ surface rather than a host – pathogen relationship. However, the results are suggestive and demonstrate the need for additional rigorous testing.

For the purposes of discussion, unless otherwise defined below, experiments examining basic biological characteristics of *Bd* use two terms to describe aspects of the life cycle (taken from Johnson and Speare 2003 and Johnson and Speare 2005): 1) “**Viability**” -- in which flagellated zoospores move freely in the medium (water, growth medium, etc.), or zoospores move within zoosporangia, or growth occurs when aliquots from water with seemingly inactive *Bd* are

subsequently injected into growth media/broth; and 2) “**Growth**” -- in which zoospores attach to a substrate (sometimes termed “encyst”) and then develop in zoosporangia, or zoosporangia change size and form, or zoosporangia release new zoospores into the medium. Work reported by Longcore et al. (1999) and Piotrowski et al. (2004) quantified growth through optical density of zoospores and zoosporangia grown in liquid medium. Finally, it is important to note that *Bd* zoosporangia might survive in a “state of arrested or nondiscernable development” for extended time periods in less than suitable environments, and then when inoculated into appropriate growth media growth begins again, i.e., the culture remains “viable” (Johnson and Speare 2003). Therefore, lack of observable activity or growth does not indicate a dead or nonviable culture (Johnson and Speare 2003), nor should that be confused with a resting spore stage, which is unknown for *Bd* (Longcore et al. 1999). Also, use of the term “**Bd-positive**” only denotes presence of the organism or its DNA, and does not necessarily equate with documented chytridiomycosis or mortalities linked to *Bd*.

The time and distance that zoospores will swim before encysting on the substrate was measured by Piotrowski et al. (2004). Although exact figures were not reported, the majority of zoospores tested (on 3, 5 cm diameter plastic culture dishes, each of which had about 200,000 zoospores) moved less than 2 cm before they encysted. About 50% had encysted by 18 hours, and 50% remained motile. By 24 hours, only about 5% were still moving; 95% had encysted. These results are consistent with one of the author’s (J.E. Longcore) observations that infected amphibian skin cells often occur in clusters, suggesting that many zoospores do not disperse long distances, but rather they infect cells in the immediate vicinity of the zoosporangia from which they were released. This also suggests that *Bd* might spread among hosts during close contact, e.g., anuran amplexus, combat, aggregating tadpoles, etc. (Piotrowski et al. 2004).

Experiments by Johnson and Speare (2003) examined the ability of *Bd* to survive and grow in tap water, deionized water and sterilized “lake” water. Although in all cases, zoospores developed into zoosporangia which attached to the plastic flask in which they were housed, only the lake water treatment subsequently released zoospores, and did so for up to seven weeks. The tap and deionized treatments did not grow, but remained viable for three to four weeks (i.e., when reinoculated in broth). Presumably, unquantified nutrients and organics in the sterilized lake water allowed *Bd* to survive longer. It is important to note that no experiments have tested the lake water result under “field” conditions, i.e., with living lake, pond, stream water, etc.. Presumably, under those conditions *Bd* zoospores would be subject to predation by a variety of free-living protists, fungi, zooplankton, etc.

Although *Bd* is generally considered to be obligately aquatic, it has been reported to survive for at least 12 weeks (= 17 – 21 generations) in sterilized, damp (33% moisture content) sand (Johnson and Speare, 2005). At least one strain grew in sand with moisture contents as low as 10%, but those results were not quantified and need to be repeated (Johnson and Speare, 2005). However, earlier experiments demonstrated that mortality occurred when zoospores were dried (i.e., “complete dessication”) for at least 3 hours (Johnson et al. 2003).

Interestingly, there is a recent report of *Bd* in the direct-developing plethodontid salamander, *Batrachoseps attenuatus*, a salamander with no aquatic habits nor an aquatic stage in its life cycle (Weinstein 2009), suggesting *Bd* is spread by direct contact, or that *Bd* can, in fact, survive

and probably disperse in moist soils. Nonetheless, mechanisms by which *Bd* can infect largely terrestrial amphibians (or disperse through seemingly unfavorable habitats) are not known, and Johnson and Speare (2005) suggest that risk of infection in terrestrial habitats will vary among soil types, moisture content and pH.

*Bd* appears to tolerate a wide range of pH. Experiments have demonstrated survival and growth from pH 5 through pH 10 (none survived at pH 3 or 4), although the best zoosporangia growth and zoospore activity occurred between pH 6 and pH 7.5 (Piotrowski et al. 2004, Johnson and Speare 2005). At pH 5, 5.5 and 8 growth was slower than between pH 6 and 7.5. At pH 9 and 10 there was early growth, but activity ceased by day 7 and 3, respectively. However, cultures that were grown at pH 9 and 10 for 1 - 2 weeks (during which they were not growing or active) and then inoculated into cultures at pH 6.7 then became active and grew (Johnson and Speare 2005). These results suggest that although *Bd* does best at near normal pH, moderate extremes do not necessarily kill the fungus, thus *Bd* can probably survive in a wide variety of aquatic habitats. Further, it is also likely that *Bd* occurring inside an amphibian host might be buffered from external pH (Piotrowski et al. 2004), including the more basic waters that are common in Arizona.

The biology of *Bd* is greatly influenced by ambient temperature. In culture, *Bd* grew at temperatures as low as 4°C (Piotrowski et al. 2004), optimum growth occurred at 23°C but slowed at 28°C, and there was (reversible) cessation of growth at 29°C (Longcore et al. 1999). Later experiments indicated that optimal growth occurred at 17° - 25° C (Piotrowski et al. 2004). *Bd* is sensitive to heat, and in culture isolates maintained at 28° C failed to grow and contained no live zoospores after 2 days (Piotrowski et al. 2004); mortality occurred at 30° C (Piotrowski et al. 2004; time of exposure not reported) and at 37°C when exposed for 4 hours (Johnson et al., 2003). *Bd* is pathogenic over a broad range of temperatures (12° - 27° C) but is most virulent from 12° - 23° C. Both pathogenicity and virulence decrease as temperature increases beyond 27° C (Skerratt et al. 2007 and references therein). In culture, short-term growth was maximal at 17°- 25° C, and zoospores encysted and developed faster into zoosporangia (Woodhams et al. 2008). However, at cooler temperatures (7° - 10° C) although zoosporangia grew more slowly, they produced greater numbers of zoospores and they remained infectious longer. Piotrowski et al. (2004) noted that the ability to grow, albeit slowly, at 4° C would permit *Bd* to survive overwintering in aquatic habitats, and as temperature rose *Bd* could reproduce rapidly. Also in culture, zoospores can be induced to release by a sudden decrease in temperature (Woodhams et al. 2008). Finally, Woodhams et al. (2008, p.1627) summarized their work by saying, “The effect of temperature on amphibian mortality will depend on the interaction between fungal growth and host immune function and will be modified by host ecology, behavior, and life history. These results demonstrate that *B. dendrobatidis* populations can grow at high rates across a broad range of environmental temperatures and help to explain why it is so successful in cold montane environments.”

Piotrowski et al. (2004) also demonstrated that *Bd* responds dramatically to different sources of nitrogen, although how those experimental nitrogen sources translate to environmental sources of nitrogen is not clear. Experiments testing the effects of phosphorus are underway at Arizona State University (O. Hyman pers. comm.).

The precise mechanism by which *Bd* kills amphibians is not yet known, but recent work provides important information. The fungus may release toxins that are absorbed through the skin, but since amphibians absorb water and often respire cutaneously, *Bd* has been thought to affect water uptake, ionic balance or respiration. Voyles et al. (2007) reported that severe chytridiomycosis in Australian green tree frogs (*Litoria caerulea*) causes decreases in blood pH, plasma osmolality and plasma sodium, potassium, magnesium and chloride concentrations, and that this imbalance in osmotic homeostasis is caused by a disruption of normal cutaneous function. Their more recent work has shown that pathophysiological changes associated with electrolyte transport across the epidermis resulted in mortality. These researchers were the first to demonstrate experimentally that disruption of cutaneous function is a likely mechanism by which *Bd* kills amphibians. They noted that in “diseased individuals, electrolyte transport across the epidermis was inhibited by >50%, plasma sodium and potassium concentrations were respectively reduced by ~20% and ~50%, and asystolic cardiac arrest resulted in death” (Voyles et al 2009, p. 582).

The degree to which *Bd* affects amphibians at the population level varies considerably, and the factors that influence individual and population responses are incompletely understood (Briggs et al., 2010). Some amphibians appear to tolerate *Bd* with few negative effects (Davidson et al. 2003, Daszak et al., 2004, Weldon et al., 2004), while its presence has been correlated with high levels of mortality in many species (Stuart et al., 2004, Lips et al. 2006,) and has also been implicated in amphibian extinctions (La Marca et al., 2005). This range of variability is also apparent in populations of Arizona anurans (see below).

In Arizona, *Bd* has been implicated in mortalities in *Bufo punctatus*, *Hyla arenicolor*, *H. wrightorum*, *Pseudacris triseriata*, *Rana berlandieri*, *R. blairi*, *R. chiricahuensis*, *R. pipiens*, *R. tarahumarae* and *R. yavapaiensis*, and has been identified in *Ambystoma tigrinum stebbinsi* and *Rana catesbeiana* (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data, O. Hyman pers. comm.). Among these species, *Bd* has been implicated in severe population declines of *Rana yavapaiensis* (Sredl 2000) and the extirpation of *Rana tarahumarae* from Arizona (T. Jones, P.J. Fernandez unpublished; see also Hale et al. 2005), yet populations of other species seem to have survived despite occasional losses of individuals to *Bd*. For example, *Bd* was confirmed in Sycamore Canyon from a 1972 *R. yavapaiensis* specimen (S. Cashins, E. Davidson, M.J. Sredl unpublished) and from dead and dying *R. yavapaiensis* and *R. tarahumarae* collected in 1974 (T. Jones, P.J. Fernandez unpublished). It is clear that Chiricahua leopard frog populations can coexist with the disease for extended periods, and in this case they have coexisted with *Bd* in Sycamore Canyon at least since 1972 (USFWS 2007), despite periodic mortalities.

Some amphibian species or populations are known to harbor *Bd* without evidence of lethal effects (e.g., Longcore et al. 2007). In Arizona, this includes native tiger salamanders (*A. t. stebbinsi*) and exotic bullfrogs (Davidson et al. 2003, Mazzoni et al. 2003). Consequently, through dispersal both species would be capable of moving or maintaining *Bd* in the environment (Collins et al. 2003, Daszak et al. 2004). Other native and nonnative frogs that are susceptible to the disease also serve as disease vectors or reservoirs of infection (e.g., Bradley et al. 2002).

## Vectors

The mechanism by which *Bd* is spread across the landscape is incompletely understood, but we know that *Bd* can be transmitted in at least two ways: 1) through the movement of infected amphibians, or 2) through movement of water (or mud) that contains zoospores or zoosporangia from infected amphibians.

As mentioned above, the most likely avenue for *Bd* dispersal is through movement of infected amphibians (either naturally or for management purposes) that then spread the pathogen to previously uninfected amphibians. Through this process the largest numbers of viable zoospores would ultimately be transferred, i.e., living, infected amphibians would continue to shed zoospores into the environment thus increasing densities of free living zoospores, and increasing the likelihood that the zoospores would contact local amphibians; a typical density dependent pattern of pathogen transmission in which an increase in density of the pathogen increases the probability of transmission.

Recent work on mountain yellow-legged frogs (*Rana mucosa* and *R. sierrae*) strongly supports the hypothesis that the frogs themselves were probably the most important agents of dispersal at the local scale (i.e., within metapopulations), although other unknown vectors contributed to movement of *Bd* across the larger landscape. At one site the data indicated that *Bd* spread through the metapopulation, mediated by dispersing frogs, in a distinct wave at a rate of approximately 688 m/year (Briggs et al. 2010, Vredenburg et al. 2010).

In Arizona, dispersal of infected native amphibians across the landscape is limited to some extent by unfavorable (usually arid) habitats that separate many amphibian populations during much of the year, and is limited to some extent by low densities of some native amphibians (e.g., native leopard frogs). Nonetheless, there are some environments (e.g., higher elevation sites, like the Kaibab Plateau, parts of the Mogollon Rim, White Mountains) where there are large contiguous tracts of favorable habitat that might remain sufficiently mesic for periods of time long enough to facilitate dispersal e.g., following snow melt or during the monsoon season. Under those conditions, infected amphibians, particularly those that harbor sub-lethal *Bd* infections (e.g., tiger salamanders) can probably move among aquatic habitats, thus dispersing the pathogen. Invasive exotic bullfrogs are extremely effective dispersers and might also be responsible for the spread of *Bd*. Studies done by biologists at the University of Arizona suggest that an individual bullfrog might move as much as seven miles over relatively flat terrain during the summer monsoon season. Although bullfrogs can succumb to chytridiomycosis (Pearl and Green 2005), to a large degree they appear to be able to support sub-lethal infections and are therefore probably effective *Bd* vectors (Daszak et al. 2004). In addition, international trade in bullfrogs for food is likely spreading *Bd* worldwide (Schloegel et al. 2009).

The AGFD has compiled data for the presence of *Bd* in bullfrogs from several sites including, San Bernardino NWR, San Pedro River, Mammoth Hot Springs, Cienega Creek watershed, San Rafael Valley, Scotia Canyon (Huachuca Mtns), Sycamore Canyon and Salty Tank (Atascosa/Pajarito Mtns), Tonto Basin, and Bubbling Ponds Fish Hatchery (BPFH) (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data; P. Rosen pers. comm.). Bullfrogs at all of these sites might disperse to nearby sites that support native amphibians.

The biology of *Bd* also suggests strongly that *Bd* might be spread by people or terrestrial animals that move among sites, one or more of which must support infected amphibians and therefore motile zoospores. Viable zoospores in water or mud could potentially be spread by wet or muddy boots or clothing, vehicles, cattle and other animals moving among aquatic sites, during scientific sampling of fish, amphibians, or other aquatic organisms, or through the direct movement of water (e.g., Johnson and Speare 2003, 2005).

The only experiments of which we are aware that test the hypothesis that terrestrial animals other than amphibians might contribute to *Bd* dispersal are by Johnson and Speare (2005). They demonstrated that *Bd* zoospores could quickly (1 minute) associate with bird feathers (chicken and duck down), and those zoospores were viable after the feathers had been removed from media for up to an hour. If given sufficient exposure to feathers (up to 4 days in media), zoospores formed attached zoosporangia. Zoosporangia on duck down survived drying up to 3 hours (note: drying was only defined as removal from media, after which the feathers were placed in a laminar flow hood), thus suggesting the disease could be spread by waterfowl or other water birds moving among wetlands. These results also support the contention that wet clothing or sampling equipment could be effective vectors for zoospores or zoosporangia. In addition, experiments mentioned above by Johnson and Speare (2005) strongly support the hypothesis that viable zoosporangia could survive transport in wet mud or sand, although the degree to which other microorganisms would affect their survivorship is unknown. Nonetheless, it is still not known how the fungus survives in the absence of amphibian populations.

Carey et al. (2006) tested the effects of *Bd* zoospore dosage (i.e., numbers of zoospores to which an animal is exposed) and length of exposure on survival time of boreal toads (*Bufo boreas*). In this experiment, juvenile toads were placed in 236 ml (~ 1 cup) containers, into which a 20 ml solution containing zoospores was added; 20 ml was sufficient volume to immerse the toads' ventral side. They found that dosage and exposure strongly influenced survival. Unsurprisingly, at high dosages (i.e.,  $10^3$  and  $10^6$  zoospores) there was 100% mortality, irrespective of exposure time. At low dosages results varied according to exposure time, however, even the lowest doses (1 zoospore/20 ml) often resulted in infection. Significantly, at the lowest doses (1, 20, 40, 60, 100 zoospores) and exposure for 1 day, percentage of toads that survived for 42 days (the duration of the experiment) ranged from 30% (100 zoospores) to 93% (1 zoospore). It is important to note that regardless of zoospore dosage, the toads were sitting in only 20 ml of solution for  $\geq 1$  day, and therefore could not escape contact with the zoospore(s). That volume of solution in a 236 ml cup would place the toad well within the swimming distance reported by Piotrowski et al. (2004). Nonetheless, there was significant survival at low doses, suggesting that higher doses of zoospores are necessary to cause lethal infections.

In a study that focused primarily on ranavirus screening, Picco and Collins (2008) tested whether the bait trade in larval tiger salamanders (waterdogs) in Arizona facilitated the dispersal of *Bd*. They used real-time PCR to screen water samples and to test salamander tissue samples from 9 bait shops that sold waterdogs. They reported positive results for *Bd* from water samples from 3 of the 9 shops, and *Bd* positive tissue from one of those 3 shops. Importantly, they discovered that many anglers surveyed (67%,  $n = 27$ ) released tiger salamanders bought as bait into the waters where they fished, and one out of 24 shops (4%) sampled in the entire study released unsold tiger salamanders into the wild after they had been kept in shops with *Bd* or ranavirus

infected animals.

### ***Bd* and fish stocking**

Depending on whether the fish being stocked originated at an AGFD hatchery or from an external vendor, operations vary, but there are three routine stocking operations by which *Bd* might be transferred from the point of origin to a stocking site. However, in each case the stocking operation process limits the probability of transmission of *Bd* (see below).

The first operation includes fish raised in open (natural) ponds that are available habitat for amphibians. These activities are limited to “incentive” fish that are raised in “show ponds” on hatchery grounds (e.g., Tonto Creek and Canyon Creek fish hatcheries). Incentive fish are generally larger fish that, when stocked into waters along with “typical” stocked fish, provide an extra incentive for anglers. Stocking incentive fish occurs infrequently, and often those fish are not stocked, but are provided to commercial entities for display (e.g., Bass Pro Shops, Cabela’s, etc.). Earthen raceways at Silver Creek hatchery are similar to open ponds, although they are flow-through systems and do not provide suitable amphibian habitats.

The second operation includes raceway raised fish (which may also include incentive fish, e.g., at Tonto Creek), in which fish are raised in artificial structures that generally are inhospitable for amphibians (i.e., they might be raised structures, concrete, rubber lined, etc.).

Finally, some fish are purchased from external vendors. These include cold water fish that are only stocked in urban fishing lakes, and warm water fish that are generally stocked in urban lakes but have been stocked in various lakes statewide. In all cases, stocking trucks are filled with clean well or spring water before fish are loaded and transferred. Table 1 outlines the procedures followed during stocking operations initiated by AGFD hatcheries and how those procedures influence the persistence of *Bd* in that operation.

At most AGFD hatcheries, the fish are raised entirely in raised tanks or in raceways that are not available to amphibians that might or might not be infected with *Bd*. Therefore, fish raised under those conditions do not present a credible threat with respect to transferring *Bd* through stocking activities.

In the rare event that incentive fish are used for stocking purposes, they are typically netted from “show ponds” or from raceways, and placed directly into stocking trucks with clean water. Show fish numbers are usually in the hundreds, and they are not mixed in trucks with regular stock (truck loads of which typically number in the thousands).

Fish are also purchased from external vendors (primarily from the southeastern U.S.). Those fish are removed from the rearing ponds and placed into truck tanks filled with well water. After loading, the tanks are flushed with well water before transit. Finally, in Texas, all tanks are again flushed with well water. Importantly, vendors are contractually obligated to provide fish that are free of disease or other pathogens as prescribed by AGFD (details depend upon species being purchased), and the loads must be free of non-target organisms (plants or animals). Loads are off-loaded in nets at the receiving point, at which time they are visually inspected for overall health and non-target organisms. Loads that fail to pass this inspection may be rejected.

The AGFD has *Bd*-positive records for amphibians occurring in the following river systems: Agua Fria (Lake Pleasant), San Francisco, Gila (tributary to mainstem), Hassayampa, Río de la Concepción, Salt, San Pedro, Santa Cruz, Verde and Río Yaqui (Bradley et al. 2002, Sredl et al. 2002, Rosen and Schwalbe 2002, Davidson et al. 2003, Garner et al. 2006, Schlaepfer et al. 2007, AGFD unpublished data).

*Bd* has been documented in bullfrogs in open hatchery ponds only at BPFH. To date, we have very few data on *Bd* on amphibians at any other AGFD hatchery, including nearby Page Springs Hatchery, but reports of amphibians in other facilities have been rare. Because bullfrogs can apparently harbor *Bd* for long periods of time without apparent ill effects (Daszak et al. 2004), the presence of bullfrogs at a hatchery presents a risk for spread of *Bd* either through spread of infected bullfrogs or tadpoles, or through spread of zoospores shed by infected bullfrogs into water that is then moved from one site to another. Note that fish stocked from AGFD hatcheries, approximately 98% of them are trout from the 5 hatcheries other than BPFH. Those fish from BPFH are primarily warm water native fish and are not stocked for sport fish purposes.

The pathways by which there is transfer of *Bd* from one environment to another depends on success of a series of events in the life cycle of the fungus: 1) a motile zoospore with a single flagellum disperses by swimming, 2) the zoospore encysts on a suitable host, 3) the resulting zoosporangium produces new zoospores, and 4) new zoospores are released into the water, where the process repeats. Under ideal conditions, the zoospore encysts on amphibian skin. Thus, the questions that must be addressed are: 1) is there a measureable risk of transporting amphibians that harbor *Bd*, and 2) is there a measureable risk of transporting viable zoospores or zoosporangia to habitats that support native amphibians, including Chiricahua leopard frogs?

1) Is there a measureable risk of transporting amphibians that harbor *Bd*?

This pathway of infectivity, transport of infected amphibians (e.g., bullfrogs) along with stocked fish, is the most effective way to transmit *Bd*. This pathway has serious consequences and if it takes place is very likely to spread the disease from one place to another. Existing AGFD HAACP plans and best management practices incorporated into hatchery operations make this highly unlikely, thus the risk of transporting infected bullfrogs or other amphibians is not significantly different than zero.

2) Is there a measureable risk of transporting viable zoospores or zoosporangia?

Although *Bd* zoospores can encyst and grow on non-living surfaces and survive for considerable periods of time under controlled conditions in vitro (Longcore et al. 1999, Johnson and Speare 2003, 2005; Piotrowski et al. 2004, Woodhams et al. 2008), we are unaware of any studies that have experimented with the ability or likelihood of zoospores to encyst and grow successfully on non-target surfaces under natural conditions (i.e., in the presence of competitive and predatory organisms). We are also aware of no data to indicate that *Bd* can encyst on fish skin, where epidermal mucous, bacterial flora, etc. of non-host organisms would probably inhibit attachment. Therefore we think it is highly unlikely that *Bd* would be carried by an alternate fish host, but acknowledge that the question remains to be tested.

Based on their experimental laboratory studies (again, in a monoculture under controlled



conditions), Johnson and Speare (2003) made the following conservative recommendations regarding the movement of water that has come into contact with *Bd* infected amphibians: 1) water should be regarded as contaminated for at least 7 weeks following last contact with infected amphibians; 2) water storage alone should not be used as a means of disinfecting water; 3) all contaminated water should be disinfected with appropriate chemical disinfectants before being discharged into the natural environment.

However, Piotrowski et al. (2004) suggested that the limited dispersal characteristics of zoospores indicate *Bd* is most likely spread by close amphibian contact. Although they acknowledge that zoospores could be carried longer distances by water currents, they also point out that passive dispersal like that “would decrease the chances of a zoospore contacting a host, because the spores would be diluted to low concentrations” (Piotrowski et al. 2004, p. 13). Serial dilutions of water that take place in standard hatchery operations would simulate the conditions noted by Piotrowski et al. (2004), i.e., zoospores would be reduced to exceedingly low concentrations. And, infection rates at those lower concentrations might be quite low (e.g., Carey et al. 2006).

Fish purchased from vendors undergo at least 2 dilutions; they are initially netted into a truck with clean water and that water is changed approximately midway during the trip to Arizona. Over the past three years of stocking, approximately 17% of the fish stocked in Arizona were provided by contract vendors. Of those contract vendor fish about 90% were stocked in Urban Fish Program (UFP) lakes that have few or no aquatic connections to sensitive native amphibian sites, and none to Chiricahua leopard frog habitats. During the 10 year period covered in this consultation, risk of transporting viable zoospores or zoosporangia via contract vendor pathway is expected to remain low because: 1) the number of fish purchased is expected to remain similar to current stocking numbers with the exception that there may be some additional locations stocked, including primarily the Fishing in the Neighborhood (FIN) waters that are located in primarily urban areas with limited hydrologic connectivity to sensitive native amphibian sites, and 2) because warm water stockings that would likely require fish purchase in response to a partial or complete loss of a fishery due to catastrophic events could occur during the 10 year period; however these stockings are not anticipated to occur only rarely.

Finally, considering the stocking protocol outlined above, there is a very small chance that some *Bd* zoospores would be released into waters stocked with fish. Those zoospores would again be diluted by the large volume of water at the stocking site. In order to complete their life cycle, the zoospores would have to encounter an amphibian and encyst on that host. The likelihood of a few zoospores in an exceedingly large volume of water coming in contact with a streamside/lakeside amphibian is, again, extremely low. In addition, depending on the stocking locations, the community of Arizona amphibians that would inhabit those waters would be limited to a few species. Most native ranids, i.e., those species that would be most likely to become infected with *Bd*, no longer occur in many of those habitats.

## Conclusions

Chytridiomycosis is an extremely serious amphibian disease, and there is no doubt that it has caused significant losses among Arizona’s native fauna. Many aspects of the natural history and

ecology of *Bd* remain to be answered, and mechanisms of dispersal beyond the actual movement of infected amphibians (e.g., Vredenburg et al. 2010) are woefully understudied. Thus, it is important to approach questions of potential spread of *Bd* with caution, and to take steps to prevent that spread. AGFD staff working with aquatic organisms (including mollusks, fishes, amphibians and reptiles) practice strict disinfectant protocols (as outlined in the Chiricahua leopard frog recovery plan [USFWS 2007]) to prevent the spread of *Bd* (and other pathogens) among populations of aquatic wildlife.

However, there are specific concerns that the AGFD hatchery stocking program might spread *Bd*. This risk has been assessed and found to be very low considering the life cycle of *Bd* (Berger et al. 2005), behavior of the zoospores (Piotrowski et al. 2004), the procedures followed in normal hatchery operations, and the precautions taken in the AGFD HACCP plan and best management practices within the hatcheries. The particular case of spreading *Bd* is one that relies on a long series of unlikely events taking place that would lead to amphibians being infected by *Bd* in areas where the disease does not already exist. Specifically: 1) a hatchery would have to be infected with *Bd*; 2) water from an infected hatchery would need to have enough *Bd* zoospores so that some individual spores would survive treatments during fish transfer and those called for in the HACCP plan; 3) zoospores would have to survive freshwater dilution in raceway raising, sorting or tagging procedures; 4) remaining zoospores would have to survive the trip in the hatchery truck to the stocking site; 5) zoospores would have to survive in the stocking area long enough to encounter an amphibian host; and 6) the amphibian host would have to develop chytridiomycosis then spread the disease to others.

Finally, Table 7 outlines the steps in stocking hatchery fish and how these steps relate to the prevention of the spread of chytridiomycosis.

**Table 7. Operations and procedures followed by AGFD hatcheries to collect, sort, transport, and stock native and nonnative fish.**

| Step                                                                                                                                                                                                                 | Notes on hatchery procedures                                                                             | Notes relevant to the persistence of <i>Bd</i>                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. fill sanitized stocking truck with spring or well water (proceed to step 2a or 2b)                                                                                                                                |                                                                                                          | if truck had been previously exposed to <i>Bd</i> zoospores, they will be killed during sanitization<br><br>truck is filled with water that has low or no likelihood of having exposure to fish, bullfrogs, or <i>Bd</i>                                                                   |
| 2a. if fish are collected from raceways, they are usually individually netted or in some cases harvested using automated equipment (contained, drained, and moved) and placed in transport truck (proceed to step 5) | raceways are inspected during feeding [daily] and cleaning [1-3 times per week] for non-target organisms | this step should get rid of <i>Bd</i> infected amphibians<br><br><i>Bd</i> zoospores will be in the residual water on the skin of fish and collecting gear or runoff from the collecting process<br><br><i>Bd</i> zoosporangia in shed amphibian skin could hatch and become free swimming |

| Step                                                                                                                                             | Notes on hatchery procedures                                                                                                                                        | Notes relevant to the persistence of <i>Bd</i>                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                  |                                                                                                                                                                     | <i>Bd</i> zoospores could remain free-swimming or encyst on the skin of a fish or on the inside of the transport truck at any step                                                                                                                                                                  |
| 2b. if fish are collected from ponds: fish and possibly frogs and tadpoles are netted or seined and moved to transport truck (proceed to step 3) | these are generally native fish, but also include incentive fish, e.g. trout<br><br>fish from raceways and ponds have residual water during collection and movement | this step should get rid of <i>Bd</i> -infected amphibians<br><br><i>Bd</i> zoosporangia in shed amphibian skin could be discharged and become free swimming<br><br><i>Bd</i> zoospores will be in the residual water on the skin of fish and collecting gear or runoff from the collecting process |
| 3. fish are placed in raceways fed by spring or well water and sorted, then placed in the stocking truck (proceed to step 4)                     | non target organisms (frogs and tadpoles) are removed during sorting                                                                                                | in raceways, <i>Bd</i> zoospores might remain on the skin of fish, but will not grow, or be placed back in “solution” and diluted or “swept away” by the flowing water of the raceway                                                                                                               |
| 4. refill unsanitized truck with spring or well water and put fish in stocking truck (proceed to step 5)                                         | truck has been drained, but not disinfected after the previous step. It may be left “empty” for some duration                                                       | truck is filled with water that has low or no likelihood of having exposure to fish, bullfrogs, or <i>Bd</i><br><br><i>Bd</i> zoospores have been diluted by the volume of water in the transport truck                                                                                             |
| 5. one to three hour drive to stocking site (proceed to step 6)                                                                                  |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                     |
| 6. acclimate water in truck to local water quality parameters (proceed to step 7)                                                                |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                     |
| 7. release fish by dumping entire load or individually netting fish                                                                              |                                                                                                                                                                     | once at the stocking site, free-swimming zoospores would have to find a suitable amphibian host, encyst, and form many zoosporangia and reinfect host                                                                                                                                               |

## Chiricahua and Northern Leopard Frog

### Introduction

The Arizona Game and Fish Riparian Herpetofauna Database contains observational data for

native ranid frogs that were collected from 1884 to present. Historical ranid frog distributions were determined from museum registers, published and gray literature reports and observations of credible individuals (for a complete list of citations, see Sredl 1997). In addition to these sources, this dataset includes data from AGFD surveys targeting native ranid frogs: *Rana blairi*, *Rana chiricahuensis*, *Rana pipiens*, *Rana subaquavocalis*, *Rana tarahumarae*, and *Rana yavapaiensis* and includes positive and negative site visits for these taxa. For complete survey methodology, see Sredl (1997).

### Historical and recent frog observations

To evaluate the status of frog populations at a stocking site or in the vicinity of that site, we considered the best available positive and negative frog survey data, habitat suitability, and survey effort (Table 8), using data from the following sources: AGFD Riparian Herpetofauna Database, HDMS, and RAPI\_from\_MacVean, Tonto National Forest (Tonto NF 1979-2008), Apache-Sitgreaves National Forest (Black Mesa (Negative) 2003-2007), and Coconino National Forest (Coconino NF 2005-2008). Positive frog observations from these sources were divided in four categories:

Observations made prior to 1980: By 1980, all currently recognized species of Arizona leopard frogs had been described or recognized (note: although the lowland leopard frog was not described until after 1980 (Platz and Frost 1984), the term “lowland form” to reference this taxon was commonly used in the literature prior to 1980). This timeframe captures what has often been used by researchers to establish baselines for status and distribution studies (e.g. Clarkson and Rorabaugh 1989, Sredl et al. 1997).

Observations made between 1980 and 1999: This timeframe includes the period when the modern taxonomy for Arizona leopard frogs became widely used in inventory, status and distribution studies. This period includes survey work by Clarkson and Rorabaugh (1989), which was the seminal paper that brought declines of Arizona ranid frogs to the attention of the research and conservation communities, and the work of Sredl et al. (1997), who conducted the first comprehensive analysis of inventory, status and distribution of Arizona ranid frogs. The work of Sredl et al. (1997) and subsequent surveys are cited as Arizona Game and Fish Riparian Herpetofauna Database in our analyses.

Observations made between 2000 and 2005: After 1999, field surveys targeting Arizona ranids began to transition from wide-ranging inventories and status and distribution studies to monitoring extant populations, evaluating sites for recovery opportunities or reconnaissance of new leopard frog populations. In addition to many records included in Arizona Game and Fish Riparian Herpetofauna Database, other datasets used in our analyses that primarily fall within this timeframe are: MacVean (RAPI\_from\_MacVean), Tonto National Forest (Tonto NF 1979-2008), Apache-Sitgreaves National Forest (Black Mesa (Negative) 2003-2007), and Coconino National Forest (Coconino NF 2005-2008).

Observations between 2005 and the present: In many cases, observations made after 2005 represent our best assessment of leopard frog populations that are extant, and are located in all data sets used in our analyses.

## Habitat suitability

Throughout the discussion of leopard frog habitat and dispersal corridors, we use the term “less suitable,” which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not leopard frogs will or can occur in a particular area. The ability of leopard frogs to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to water availability, cover, prey, predators, etc.. Stocking sites or stream reaches would be considered “less suitable” for leopard frogs when there are known reasons in conditions that generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for leopard frogs because they exert predatory or competitive pressures on the frogs.

## Frog occupancy

It is difficult to determine if frogs are absent from a site or area. In order to make that determination, we used a “preponderance of evidence approach” to build a case that frogs are present or absent. We acknowledge that these criteria are imperfect, but they utilize the best available data in a consistent manner.

1. Frog sites / stocking complexes will be considered occupied if they contain
  - a. extant populations of frogs, defined as sites that have positive observations for Chiricahua or northern leopard frogs made from 2006 to the present, or
  - b. locations where frogs were observed one or more times from 2000 through 2005 and habitat is in good condition and therefore could contribute to “recovery” (e.g. those sites in a Chiricahua Leopard Frog Management Area (MA))
2. Frog sites / stocking complexes may be occupied
  - a. if they are located in the historical range (i.e. within the approximate boundaries of a Chiricahua Leopard Frog Recovery Unit [RU]) and contain positive observations from 1980 through 1999 but there have been no subsequent surveys or
  - b. if they are located in the historical range and contain leopard frog records that were made prior to 1980 and the area has been poorly surveyed
3. Frog sites / stocking complexes will be considered unoccupied if they are
  - a. outside the historical range (i.e. RUs) or
  - b. within the historical range and contain no positive observation made through 1999 and
    - i. areas that have been well-surveyed and all survey results are negative at both historical and non-historical localities or
    - ii. there has been a no post-1999 positive reports from areas that are frequently visited by knowledgeable biologists or
    - iii. presence of degraded habitats (e.g. those that are dewatered or contain many nonnatives) and all surveys subsequent to 1999 are negative

**Table 8. Criteria used and data considered to characterize the likelihood that Chiricahua or northern leopard frogs occupy a site or area.**

| Status          | Occurrence data                                                                | Habitat suitability                                                                                                     | Survey effort                                                                                                                                                                                                                 |
|-----------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupied        | extant frog population<br>(= positive observations from 2006 to present)<br>or | NA                                                                                                                      | NA                                                                                                                                                                                                                            |
|                 | frogs observed from 2000 through 2005                                          | ... <u>and</u> habitat is in a condition such that it could contribute to "recovery" (i.e. area is in CLF MA)           | NA                                                                                                                                                                                                                            |
| May be occupied | frogs observed from 1980 through 1999<br>or                                    | ... <u>and</u> in historical range (~RU)                                                                                | <u>but</u> there have been no subsequent surveys                                                                                                                                                                              |
|                 | frogs observed prior to 1980                                                   | ... <u>and</u> in historical range (~RU)                                                                                | <u>and</u> area has been poorly surveyed                                                                                                                                                                                      |
| Unoccupied      | frogs observed through 1999                                                    | ... <u>and</u> in historical range (~RU)                                                                                | <u>and</u> well-surveyed area and results include only negative surveys at both historical and non-historical localities<br>or<br>lack of positive reports from areas that are frequently visited by knowledgeable biologists |
|                 | frogs observed through 1999                                                    | ... <u>and</u> in historical range (~RU) <u>and</u> the prevalence of degraded habitats (dewatered, many nonnatives...) | <u>and</u> all surveys subsequent to 1999 are negative                                                                                                                                                                        |

## Developing Buffered Stocking Complexes

### Local Analysis

To evaluate both the likelihood that a site or local area is occupied by Chiricahua and northern leopard frogs, and the level of exposure of stocked fish to these leopard frogs, we developed a buffered stocking complex approach by creating a minimum convex polygon (MCP) around all stocking sites within a stocking complex, and buffering this MCP by 5 miles.

In most cases we used the buffered MCP approach to circumscribe the entire stocking complex, but in three stocking situations we had to depart from this approach and create sub-complexes. These situations arose when stocking sites in complexes consisted of: 1) fewer than 3 sites, 2)

sites that were isolated and distant from other stocking sites, or 3) only stream reaches. In these cases, a 5 mile buffer was made around individual stocking sites or around the entire stocking reach. A buffered MCP or a 5 mile buffer was applied only to those sites or complexes that lie within the known historical range of Chiricahua and northern leopard frogs. Some stocking complexes were so large or heterogeneous (e.g. Middle Verde River stocking complex), we divided the complex into smaller, more manageable sub-complexes comprising one of more of the three situations outlined above.

We analyzed potential impacts of stocking at two levels, the local and broad scales. For the local analyses, we used each buffered stocking complex to limit our query of historical and visual encounter survey data. We then used these data to consider at the local level the likelihood of occupancy and exposure to stocked fish. Water distribution and connectivity within each stocking complex was reviewed thoroughly to fully understand the ability and likelihood of fish and frog movement within the buffered stocking complexes, reaches or sites.

### **Broad Scale Analysis**

The likelihood of occupancy of Chiricahua and northern leopard frogs and exposure to stocked fish were evaluated on a broader scale by assessing potential movement of fish and frogs upstream and downstream beyond the buffered stocking complex, reach, or individual site. The water distribution and connectivity portion of each stocking complex was reviewed thoroughly to fully understand the ability and likelihood of fish and frog movement outside of the buffered stocking complexes, reaches or sites.

### **Determining exposure: Dispersal of fish and frogs**

To evaluate the likelihood that dispersing Chiricahua or northern leopard frogs could be exposed to stocked fish, we used data on flow, distance, and other attributes of corridor suitability for fish and frogs to make this determination (see Table 9 for criteria examined). By circumscribing a distance of 5 miles around all stocking sites within a stocking complex, we considered all possible distances that Chiricahua and northern leopard frogs are reasonably likely to disperse (1 mile overland, 3 miles along intermittent drainages, and 5 miles along permanent drainages, see USDA Forest Service Southwestern Region 2004, Chiricahua Leopard Frog Recovery Plan 2007 and references therein). For details on buffering stocking complexes, see section below.

**Table 9. Criteria used to characterize the likelihood of exposure of dispersing Chiricahua or northern leopard frogs to stocked fish.**

*Flow was categorized by the predominant flow type (perennial or intermittent, or none), while considering additional information on water distribution and potential for frogs and fish to disperse through that corridor. Distance between occupied frog sites and stocking sites was measured in ArcGIS. Known reasons that alter the “suitability of dispersal corridor” include natural and manmade barriers to dispersal of stocked fish and presence of nonnative aquatic species (crayfish, fish, and bullfrogs).*

| <b>Likelihood of Exposure</b> | <b>Flow</b> | <b>Distance (miles)</b> | <b>Suitability of dispersal corridor</b> |
|-------------------------------|-------------|-------------------------|------------------------------------------|
| High                          | Perennial   | < 5                     | NA                                       |

|          |              |      |                                                                                                             |
|----------|--------------|------|-------------------------------------------------------------------------------------------------------------|
|          | Intermittent | < 3  | NA                                                                                                          |
| Moderate | Perennial    | > 5  | There are known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish      |
|          | Intermittent | > 3  | There are known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish      |
| Low      | Perennial    | >> 5 | There are many known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish |
|          | Intermittent | >> 3 | There are many known reasons that decrease the likelihood of dispersing frogs being exposed to stocked fish |

In order to evaluate the likelihood that Chiricahua or northern leopard frogs could be exposed to dispersing stocked fish, we used data on flow and other attributes of corridor suitability found in the watershed chapters to make this determination (see Table 10 for criteria examined).

**Table 10. Criteria used to characterize the likelihood of exposure of Chiricahua or northern leopard frogs to dispersing stocked fish. Flow and known reasons that alter the “suitability of dispersal corridor” determined as in Table 9.**

| Likelihood of Exposure | Flow                                         | Suitability of dispersal corridor                                                                           |
|------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| High                   | Perennial                                    | NA                                                                                                          |
| Moderate               | Perennial                                    | There are known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish      |
|                        | Intermittent (may contain substantial pools) | There are known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish      |
| Low                    | Perennial                                    | There are many known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish |
|                        | Intermittent                                 | There are many known reasons that decrease the likelihood of frogs being exposed to dispersing stocked fish |

### Northern Mexican Gartersnake

#### Range wide discussion

Northern Mexican gartersnakes are closely associated with riparian areas and typically inhabit cienegas, perennial streams, rivers, earthen stock tanks, and ponds with thick bank vegetation (Holycross et al. 2006; Rosen and Schwalbe 1988). Their historical range wide distribution



extends from central Arizona and west-central New Mexico south along the Sierra Madre Occidental to west-central Veracruz and also includes isolated populations in central Oaxaca and central Nuevo Leon, Mexico (Holycross et al 2006). In Arizona, northern Mexican gartersnakes were historically found between 500-2050 m (1640-6725 ft) elevation and have been previously documented from Tonto Creek, upper Verde River, Agua Fria River, Salt/Black River, Little Colorado River, San Bernardino Ranch, San Pedro River, Altar Wash, and Santa Cruz River watersheds (Holycross et al. 2006). While they were once considered common, northern Mexican gartersnakes are believed to have declined substantially throughout their range and are now candidates for Federal listing under the Endangered Species Act.

Using the best available data, the USFWS determined in their 12-month finding (USFWS 2008b) that northern Mexican gartersnakes are likely extant at the following locations: Santa Cruz River/Lower San Rafael Valley, Verde River from the confluence with Fossil Creek upstream to Clarkdale, Oak Creek at Page Springs, Tonto Creek from the mouth of Houston Creek downstream to Roosevelt Lake, Cienega Creek from the headwaters downstream to the "Narrows" just downstream of Apache Canyon, Pantano Wash (Cienega Creek) from Pantano downstream to Vail, Appleton-Whittell Research Ranch and vicinity near Elgin, and Red Rock Canyon east of Patagonia. They determined that it is unknown whether the species is still extant at the following locations: downstream portion of the Black River drainage from the Paddy Creek confluence, downstream portion of the White River drainage from the confluence of East and North forks, Big Bonito Creek, Lake O' Woods near Lakeside, Spring Creek above the confluence with Oak Creek, Bog Hole Wildlife Area, Upper 13 Reservoir, Patagonia Mountain bajada, Babocomari River, Upper Scotia Canyon in the Huachuca Mountains, Arivaca Cienega, Gila River at Highway 180. The species is considered likely extirpated from the following locations: the Gila River, Lower Colorado River from Davis Dam to the International Border, the San Pedro River, Santa Cruz River downstream from the International Border at Nogales, Salt River, Rio San Bernardino from International Border to headwaters at Astin Spring (San Bernardino National Wildlife Refuge), Agua Fria River, Verde River upstream of Clarkdale, Verde River from the confluence with Fossil Creek downstream to its confluence with the Salt River, Tanque Verde Creek in Tucson, Rillito Creek in Tucson, Agua Caliente Spring in Tucson, Potrero Canyon/Springs, Babocomari Cienega, Barchas Ranch, Huachuca Mountain bajada, Parker Canyon Lake and tributaries in the Canelo Hills, and Oak Creek at Midgley Bridge (USFWS 2008b).

### Home range

Home range information is lacking for northern Mexican gartersnakes, however, a study in British Columbia found that for adult terrestrial gartersnakes (*Thamnophis elegans*), a species similar to northern Mexican gartersnakes, home-range varied from 10 to 100,000 m<sup>2</sup> (108 to 1,076,391 ft<sup>2</sup>) and that they often migrated nearly 3 km (1.86 mi) in a season (Graves and Fuvall 1990, Farr 1988, cited in Rossman et al. 1996). Additionally, common gartersnakes, *T. sirtalis*, from Manitoba made long distance movements between hibernation sites and feeding areas which ranged from 4.3 to 17.7 km (2.67 to 11 mi) (Gregory and Steward 1975, cited in Rossman et al. 1996). In a Kansas study, the mean activity area for *T. sirtalis* ranged from 92,000 m<sup>2</sup> (990,280 ft<sup>2</sup>) for females to 142,000 m<sup>2</sup> (1,528,475 ft<sup>2</sup>) for males (Fitch 1965, cited in Rossman et al. 1996), and in Michigan, their range was recorded at 8000 m<sup>2</sup> (86,111 ft<sup>2</sup>) (Carpenter 1952,

cited in Rossman et al. 1996). In yet another study, researchers found that recaptured gartersnakes were rarely found more than 160 m (525 ft) from their original capture locations (Freedman and Catlin 1979, cited in Rossman et al. 1996).

While northern Mexican gartersnakes are likely capable of large-scale overland movements similar to those described above for other gartersnake species, the frequency at which they occur is unclear. Though they are rarely found more than 15 m (52 ft) from permanent water, observations of this species from the San Rafael Valley, Arizona, indicate that northern Mexican gartersnakes can wander overland and be found several kilometers from riparian areas (e.g., cienegas and rivers) (Rosen and Schwalbe 1988). For example, northern Mexican gartersnakes have been found at overland distances of 3 km (1.86 mi) (FS799 tank) and 6.2 km (3.85 mi) (Upper 13 Reservoir) from the Santa Cruz River despite a lack of aquatic connectivity (T. Jones pers. comm.). While it is unclear whether the observations were of dispersing individuals or resident snakes, these data support the suggestion that this species, similar to other gartersnakes, is capable of moving across the landscape and can persist at sites beyond riparian corridors. The large-scale movements described for similar species listed above likely reflect their need to move between limited suitable hibernation locations and feeding areas during the active season. The average distance northern Mexican gartersnakes travel between hibernation sites and active season feeding areas is currently unknown.

Snakes are cryptic by nature and their detectability is generally low, even among common species. Currently, no standard survey protocol exists for detecting northern Mexican gartersnakes, however, researchers employ similar field techniques which include trapping with mesh minnow traps, visual searching, dip-netting, and turning cover objects (boards, rocks, logs, etc.). The area covered and duration of trapping and visual searching periods often vary by site and over time. It is difficult to quantify the degree to which populations of northern Mexican gartersnakes have declined over time because long-term demographic data are generally lacking. There are few comparisons of relative abundance between/among sites and those are typically quantified through catch per unit effort (e.g., person-search hours and trap-hours), however, this measure does not account for habitat variables or other covariates that might influence detectability. Often, and as is the case for gartersnakes, these indices of relative abundance constitute the best available information from which management decisions must be made for a species. While the assumption is often made that snakes will be detected if present at a site, it is necessary to use caution when interpreting relative abundance or presence/absence data and extrapolating across sites.

To demonstrate how detectability varies with survey design and effort, we offer two examples from a similar area along the Santa Cruz River in the San Rafael Valley, Arizona. In 2000, Rosen et al. (2001) reported results from trapping and surveying efforts along the main-stem of the Santa Cruz River (~11 hrs dip-netting and general searching; 1 trapping array for 24 hr), Heron Spring (10 min general searching; 1 gartersnake fyke trap for 48 hr), and Sharp Spring (45 min general searching; 1 trapping array for 48 hr). Across six survey days, only five northern Mexican gartersnakes were observed and none trapped. The number of traps deployed within each array was not reported, thus it is not possible to quantify trap effort accurately. Based on their results, Rosen et al. (2001) concluded that the population was persisting and may not be declining rapidly, though there were no means of comparison from previous years. Conversely,

AGFD staff implemented two intensive 8-day trapping sessions (~100 traps spaced 25 m [82 ft] apart during each session) along a 2.7 mile (4.5 km) stretch of the Santa Cruz River extending north from the U.S./Mexico border within the San Rafael State Natural Area. During 15.4 days (1553.6 trap days), 52 northern Mexican gartersnakes were captured and individually marked. An additional three gartersnakes were observed but not captured. It might appear that this population increased in size based on raw numbers of captures in 2008 vs. those including the same area in 2000; however, the difference in capture numbers likely results from differences in survey design and trapping efforts. All but two of the snakes captured in 2008 were large adults, which suggest low recruitment rates within the population (M. Ingraldi, R. Mixan pers. comm.). Both studies indicate that northern Mexican gartersnakes persist along the upper Santa Cruz River in the San Rafael Valley, but it is not possible to evaluate the viability of the population without further study. As these two examples demonstrate, detectability varies with survey design and effort, thus it is necessary to use caution when interpreting relative abundance or presence/absence data and extrapolating across sites.

### **Criteria Developed:**

We evaluate the potential for exposure of northern Mexican gartersnakes to stocked sport fish for each watershed in which the USFWS determined that populations are extant or of unknown status (USFWS 2008b). For those watersheds in which gartersnake populations existed historically but are currently believed extirpated, we determined that northern Mexican gartersnakes are unlikely to occupy the stocking complex and that there was no likelihood of exposure to stocked sport fish. The likelihood of exposure to stocked sport fish was not evaluated for watersheds that lie outside the known historical range of the species. As described above, similar gartersnake species are capable of long-distance movements exceeding several kilometers during their active seasons. While home range and movement data are lacking for northern Mexican gartersnakes, we assume they too are capable of such large movements both overland and along drainages. The frequency at which these movements occur is unclear but likely correlates with prey availability in a system, reproductive activity, postpartum dispersal, etc. Throughout the discussion of gartersnakes, AGFD uses the term “less suitable,” which requires some discussion/definition. There is no definitive set of criteria that dictate whether or not gartersnakes will or can occur in a particular area. The ability of gartersnakes to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to cover, prey, predators, etc. While some sites might be capable of supporting large adult snakes, those same sites might not allow for successful recruitment. Stocking sites or stream reaches would be considered “less suitable” for gartersnakes when local conditions generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for gartersnakes because they exert predatory or competitive pressures on the snakes. However, gartersnakes might continue to persist in “less suitable” sites in the presence of nonnative species if those sites have greater habitat complexity and provide escape cover or feeding sites for neonates or juvenile snakes. An example of this would be Mexican gartersnakes on the middle Verde River, where although we have few data on population status, snakes appear to persist in exceedingly complex riparian habitat in some areas (e.g., Dead Horse Ranch State Park) despite the presence of bullfrogs, crayfish and predatory fishes.

In addition, there are sites within the elevational range of gartersnakes where distributional data suggest gartersnakes do not occur, but other structural habitat features seem to be appropriate. Although lack of data does not necessarily equate with absence, if there are additional habitat characteristics (predators, lack of cover, etc.) that would preclude gartersnakes from occupying those sites or thriving, we also refer to those sites as “less suitable” which contributes to a conclusion that snakes probably do not occur there.

### **Stocking complex analysis:**

Following methods similar to those described for Chiricahua and northern leopard frogs, we used ArcGIS to map and identify sport fish stocking complexes from which positive observations of northern Mexican gartersnakes exist and that lie within the historical range of the species (Rosen and Schwalbe 1988, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database). We then developed a similar buffered stocking complex approach by creating a minimum convex polygon (MCP) around all stocking sites within a stocking complex, and then buffering the MCP by 20 km (12.43 mi). This buffer was developed after evaluating the best available home range and movement data for similar gartersnake species and northern Mexican gartersnake observations described above, and it represents a conservative estimate of distances that northern Mexican gartersnakes might make along ephemeral or perennial drainages. Overland movements will likely be <20 km, however, over ecological time, gartersnakes within a population could move long distances in search of food or suitable habitat. Within some stocking complexes, stocking sites were widely separated from one another and were therefore considered separately, in which case a circular buffer with a 20 km (12.43 mi) radius was created around each stocking site (e.g., Santa Cruz stocking complex). Within each of these buffered stocking complexes, we evaluated the potential for northern Mexican gartersnakes to be exposed to stocked sport fish by considering the criteria described below and detailed in Table 11.

It is difficult to determine whether gartersnakes occupy a site/area because their detectability is low and recent systematic surveys have generally not been conducted in most areas. Therefore, to make our determination, we built a case using positive observations reported from HDMS, the Arizona Game and Fish Riparian Herpetofauna Database, and the USFWS (2008a) 12-month finding to determine whether or not northern Mexican gartersnakes are likely to occupy each buffered stocking complex. Rosen and Schwalbe (1988) began the first large-scale surveys for gartersnakes in 1985, which contributed to our understanding of their recent distributions in Arizona. Therefore, occupancy was described according to whether observations were made prior to or after 1985. Then based on the occupancy determinations, we evaluated whether there is a likelihood of exposure to stocked sport fish, as described below and detailed in Table 11. We did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

1. Occupancy—stocking complexes will be considered:
  - a. Occupied—if there are positive gartersnake observations within the complex since 1985 (Rosen and Schwalbe 1988, Rosen and Schwalbe 2001, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database) or the USFWS determined that the species is likely extant (USFWS 2008b).

- b. May be occupied—if gartersnake records exists prior to 1985, but since then either surveys have been conducted and no snakes have been found, no systematic surveys have been conducted and habitat condition has diminished (e.g., bullfrogs or crayfish are present), or the USFWS has determined that its status is unknown.
  - c. Unoccupied—if a single historical record exists (prior to 1985) but no observations have been made since, the USFWS (2008a) has determined that the species is likely extirpated, or the area lies outside the historical range of the species (Rosen and Schwalbe 1988, Rosen and Schwalbe 2001, Holycross et al. 2006, HDMS).
2. Likelihood of exposure:
- a. Exists—if there is a known population of northern Mexican gartersnakes occupying the complex or snakes are likely to move into the stocking complex because they persist nearby, then there is a likelihood that snakes could encounter stocked sport fish.
  - b. Low—if the status of northern Mexican gartersnake populations is unknown in the complex, or the habitat is less suitable because there are other invasive species already present, such as bullfrogs and crayfish, then there is a low likelihood that snakes could encounter stocked sport fish.
  - c. Does not exist—if northern Mexican gartersnakes are likely extirpated from a stocking complex or the area lies outside the historical range of the species, then it is unlikely that snakes will encounter stocked sport fish.

**Table 11. Criteria for determining whether northern Mexican gartersnakes occupy a site/stocking complex and the likelihood of exposure to stocked sport fish.**

| Status          | Available data/habitat condition                                                                                                                                                                                                                                                                      | Likelihood of exposure                                     |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Occupied        | Records >1985; USFWS (2008a) determined status as likely extant.                                                                                                                                                                                                                                      | Exists (positive)—species known to occupy area.            |
| May be occupied | Records exist <1985, but no systematic surveys have been conducted;<br><u>or</u> , surveys have been conducted but no snakes were observed;<br><u>or</u> , habitat condition is diminished (e.g., invasive bullfrogs or crayfish present);<br><u>or</u> , USFWS (2008a) determined status as unknown. | Low—species may occupy area or habitat suitability is low. |
| Unoccupied      | Single historical record exists (<1985), but no observations since then;<br><u>or</u> , USFWS (2008a) determined status as likely extirpated;<br><u>or</u> , area lies outside historical range.                                                                                                      | Does not exist (negative)—species is unlikely to occur.    |

#### **Downstream analysis:**

There is potential for northern Mexican gartersnakes to occur downstream of stocking sites, stocking stream reaches and outside buffered stocking complexes. Therefore, after carefully examining water connectivity and potential fish movement as described within each stocking

complex chapter, we analyzed the likelihood that gartersnakes could be exposed to dispersing sport fish or that gartersnakes will move into the stocking complexes based on the occupancy criteria presented in Table 11, above.

### Narrow-headed Gartersnake

#### Range wide discussion

Narrow-headed gartersnakes are one of the most aquatic gartersnake species, only leaving the water to bask, rest, or gestate (Rosen and Schwalbe 1988; Rossman et al. 1996). The species is confined to primarily large, perennial streams within montane and Great Basin conifer woodlands, chaparral, and upland desert scrub. Important microhabitats include the submerged rock-boulder complexes near riffles and pools, and thick backside vegetation used for basking and escaping from predators (Rosen and Schwalbe 1988, Degenhardt et al. 1996). Narrow-headed gartersnakes also appear to be strongly tied to boulders, rock piles, and other cover structures that lie within the floodplain of creeks (Nowak 2006).

The historical range wide distribution for narrow-headed gartersnakes includes permanent drainages of the Mogollon Rim and White Mountains of Arizona and New Mexico, and the Sierra Madre Occidental in Mexico. They are primarily found at elevations of 1200-1900 m (3937-6234 ft), but have been observed at elevations of 700-2430 m (2297-7972 ft) (Holycross et al. 2006). In Arizona, narrow-headed gartersnakes are found in headwater streams of the Gila River watershed.

Narrow-headed gartersnakes forage for prey along stream banks, in shallow riffles, and between boulders within the stream (Rossman et al. 1996, Pierce 2007). Small soft-rayed fishes make up their primary diet (Nowak and Santana-Bendix 2002), which includes suckers, rainbow trout, red shiner, speckled dace. They have also been reported to prey on larval and adult anurans and larval tiger salamanders (Degenhardt et al. 1996). Narrow-headed gartersnakes will, to a lesser extent, take spiny-rayed fish such as sunfish and catfish (Degenhardt et al. 1996, Pierce 2007). Nonnative spiny-rayed fishes are thought to be unsuitable prey because narrow-headed gartersnakes cannot safely ingest the fish without them becoming lodged in their throats or causing other physical damage to the digestive tract (Nowak and Santana-Bendix 2002). Narrow-headed gartersnakes have experienced significant population declines throughout their range in Arizona and New Mexico (Holycross et al. 2006, Pierce 2007). Holycross et al. (2006) surveyed for gartersnakes during 2004 and 2005 and only found narrow-headed gartersnakes at 5 of 16 known historical Arizona localities. Based on those surveys, Holycross et al. (2006) concluded that the species was likely extirpated from 5 of the surveyed sites. Furthermore, narrow-headed gartersnakes have experienced significant declines at one of the largest known populations in Arizona in Oak Creek Canyon. As a result of recent (2002, 2004, and 2005) surveys, Nowak and Santana-Bendix (2002) and Nowak (2006) determined that narrow-headed gartersnakes may be extirpated from sites downstream of Oak Creek Canyon. Also, they suggested that while snakes in the upper reaches of the canyon appear to be persisting, there is a declining trend in numbers of snakes detected in the lower reaches of the canyon.

As with other gartersnake species in Arizona, multiple stressors are likely contributing to this species' decline (Nowak 2006). Nonnative predators such as fish, crayfish, and bullfrogs are believed to be the main cause of decline for the species throughout its range, however, other

major threats include habitat destruction and degradation associated with aquatic recreation, urbanization, and overgrazing (Rosen and Schwalbe 1988, Rossman et al. 1996, Nowak and Santana-Bendix 2002).

### **Home Range Size:**

All home range information for this species is based on one radio-telemetry study (n = 4 males, 5 females) at Oak Creek Canyon (Nowak 2006). Narrow-headed gartersnakes appear to have intermediate home range sizes compared to published home ranges for other gartersnake species, with males, on average, having a larger home range than females. Home ranges of males at Oak Creek Canyon were up to 2.2 ha (5.44 acres) in size, while female home range was up to 1.1 ha (2.72 acres) in size. Home ranges, especially those of males, were very linear, as would be expected for a snake that does not venture far from stream habitats during their active season (March through October/November). During their active season, narrow-headed gartersnakes used upland areas up to 100 m (328 ft) from the creek, but were strongly associated with boulders within the floodplain. Hibernacula consisted of rock piles, hillsides with small rocks, boulders, and rock overhangs located 20-200 m (66-656 ft) from the creek. There are no data available describing long distance movements in narrow-headed gartersnakes. However, Harter's watersnake (*Nerodia harteri*) is a snake of similar size, habits and ecological characteristics, has been well studied in rivers in Texas, and provides an ecological analogue with which to predict movements in narrow-headed gartersnakes (Hibbitts and Fitzgerald 2005). Harter's watersnakes also typically move relatively short distances during a season, e.g., approximately 150-460 m (493-1509 ft), but over several years, one male moved 19 km (11.8 mi) (Greene 1993, cited in Gibbons and Dorcas 2004, Whiting and Dixon 1997). Therefore, similar long-distance dispersal might be expected in narrow-headed gartersnakes. Although the downstream movement potential during high water events is unknown, narrow-headed gartersnakes are probably unlikely to make large overland movements, since the species is highly dependent on water for foraging.

### **Criteria Developed:**

As described above, narrow-headed gartersnakes are riparian obligates and they forage almost exclusively on fishes. While home range and movement data are limited for narrow-headed gartersnakes, we assumed the frequency at which narrow-headed gartersnakes will make large overland movements is extremely low (i.e., rarely found >200 m [219 ft] from stream edge) and that they will travel linearly along narrow perennial riparian corridors. By examining the inter-connectivity of the perennial waterways and fish movements as described within the stocking complex chapters, we evaluated the potential for exposure of narrow-headed gartersnakes to stocked sport fish for each watershed in which there are positive records for the species. For those watersheds in which gartersnake populations existed historically but are currently believed extirpated or of unknown status (Holycross et al. 2006), we determined that narrow-headed gartersnakes are unlikely to occupy the stocking complex and that there was no likelihood of exposure to stocked sport fish. The likelihood of exposure to stocked sport fish was not evaluated for watersheds that lie outside the known historical range of the species or for which there is a single historical record prior to 1985 and no additional observations.

Throughout the discussion of gartersnakes, AGFD uses the term "less suitable," which requires

some discussion/definition. There is no definitive set of criteria that dictate whether or not gartersnakes will or can occur in a particular area. The ability of gartersnakes to occupy a site and subsequently thrive there depends on a number of habitat characteristics, including, but not limited to cover, prey, predators, etc.. While some sites might be capable of supporting large adult snakes, those same sites might not allow for successful recruitment. Stocking sites or stream reaches would be considered “less suitable” for gartersnakes when local conditions generally reduce or prevent successful recruitment, and thus population persistence. For example, the presence of bullfrogs, crayfish, or predatory fishes could make the site less suitable for gartersnakes because they exert predatory or competitive pressures on the snakes. However, gartersnakes might continue to persist in “less suitable” sites in the presence of nonnative species if those sites have greater habitat complexity and provide escape cover or feeding sites for neonates or juvenile snakes. An example of this would be Mexican gartersnakes on the middle Verde River, where although we have few data on population status, snakes appear to persist in exceedingly complex riparian habitat in some areas (e.g., Dead Horse Ranch State Park) despite the presence of bullfrogs, crayfish and predatory fishes.

In addition, there are sites within the elevational range of gartersnakes where distributional data suggest gartersnakes do not occur, but other structural habitat features seem to be appropriate. Although lack of data does not necessarily equate with absence, if there are additional habitat characteristics (predators, lack of cover, etc.) that would preclude gartersnakes from occupying those sites or thriving, we also refer to those sites as “less suitable” which contributes to a conclusion that snakes probably do not occur there.

### **Stocking complex analysis:**

We used ArcGIS to map and identify sport fish stocking complexes for which positive observations of narrow-headed gartersnakes exist and that lie within the historical range of the species (Nowak and Santana-Bendix 2002, Nowak 2006, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database). Because narrow-headed gartersnakes are unlikely to make long distance overland movements, we did not analyze the potential for exposure to stocked sport fish at sites in which it would be necessary for gartersnakes to travel >0.25 mile (>0.4 km) overland to reach those sites. For stocking sites with aquatic connectivity, we took a conservative approach and assumed that narrow-headed gartersnakes can move upstream and downstream throughout the stocking complex, similar to fish movements. To analyze the likelihood of exposure to stocked sport fish, we first determined whether narrow-headed gartersnakes occupy the area according to the criteria listed below and described in Table 12, and then examined the degree of aquatic connectivity that would permit gartersnakes to move through the stocking complex. Similar to our analysis for northern Mexican gartersnakes, we did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

As discussed above for northern Mexican gartersnakes, it is difficult to determine whether gartersnakes occupy a site/area because their detectability is low and systematic surveys have generally not been conducted in most areas. Therefore, to make our determination, we built a case using positive observations reported from HDMS, the Arizona Game and Fish Riparian



Herpetofauna Database, and (Heritage) reports to AGFD to determine whether or not narrow-headed gartersnakes are likely to occupy each stocking complex. Rosen and Schwalbe (1988) began the first large-scale surveys for gartersnakes in 1985, which contributed to our understanding of their recent distributions in Arizona. Therefore, occupancy was described according to whether observations were made prior to or after 1985. Then, based on the occupancy determinations, we evaluated whether there is a likelihood of exposure to stocked sport fish, as described further below and detailed in Table 12. We did not make a qualitative assessment for the likelihood of exposure (e.g., high, medium, low) because sufficient surveys have not been conducted in most areas and the status of most populations is unknown.

1. Occupancy—stocking complexes will be considered:
  - a. Occupied—if there are positive gartersnake observations within the complex since 1985 (Rosen and Schwalbe 1988, Nowak and Santana-Bendix 2002, Holycross et al. 2006, HDMS, Arizona Game and Fish Riparian Herpetofauna Database) and suitable habitat exists.
  - b. May be occupied—if gartersnake records exist prior to 1985, but since then either surveys have been conducted and no snakes have been found or no systematic surveys have been conducted and habitat condition has diminished (e.g., bullfrogs or crayfish are present).
  - c. Unoccupied—if a single historical record exists (prior to 1985) but no observations have been made since, habitat is unsuitable for the species (e.g., closed basin lakes), or the area lies outside the historical range of the species as identified by Holycross et al. (2006).
2. Likelihood of exposure—level of exposure:
  - a. Exists—if there is a known population of narrow-headed gartersnakes occupying the complex or snakes are likely to move into the stocking complex because they persist nearby, then there is a likelihood that snakes could encounter stocked sport fish.
  - b. Exists but is low—if the status of narrow-headed gartersnakes is unknown in the complex, the habitat is less suitable because there are other invasive species already present, such as bullfrogs and crayfish, or the species would need to make large overland movements in order to reach the stocking complex, then there is a low likelihood that snakes could encounter stocked sport fish.
  - c. Does not exist—if narrow-headed gartersnakes are unlikely to occupy the area because it is not suitable habitat or the complex lies outside the historical range of the species, then it is unlikely that snakes will encounter stocked sport fish.

**Table 12. Criteria for determining whether narrow-headed gartersnakes occupy a site/stocking complex and the likelihood of exposure to stocked sport fish**

| Status          | Available data/habitat condition                                                                                                                                                                  | Likelihood of exposure                                                                                                                           |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupied        | Records >1985 ; and suitable habitat exists.                                                                                                                                                      | Exists (positive)—species known to occupy area.                                                                                                  |
| May be occupied | Records exist <1985, but no systematic surveys have been conducted;<br><u>or</u> , surveys have been conducted but no snakes were observed;<br><u>or</u> , habitat condition is diminished (e.g., | Low—species may occupy area; <u>or</u> , habitat suitability is low; <u>or</u> , large overland movement necessary for species to reach stocking |

| Status     | Available data/habitat condition                                                                                                                                                                 | Likelihood of exposure                                  |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|            | invasive bullfrogs or crayfish present).                                                                                                                                                         | complex.                                                |
| Unoccupied | Single historical record exists (<1985), but no observations since then;<br><u>or</u> , habitat is unsuitable for the species (e.g., lakes);<br><u>or</u> , area lies outside historical range . | Does not exist (negative)—species is unlikely to occur. |

### Downstream analysis:

There is potential for narrow-headed gartersnakes to occur downstream of stocking sites, stocking stream reaches and outside buffered stocking complexes. Therefore, after carefully examining water connectivity and potential fish movement as described within each stocking complex chapter, we analyzed the likelihood that gartersnakes will be exposed to dispersing sport fish or that gartersnakes will move into the stocking complexes based on the occupancy criteria presented in the table below.

## Chapter 4 Species Analyses

### Species Interactions and Effects Analysis

#### Interactions between stocked fish and native fish species

##### *Introduction*

The decline of native aquatic species is primarily attributed to numerous human-induced disturbances including dam construction, irrigation development, and community development which produced impacts such as habitat loss, habitat change, and variations in water temperatures and flow characteristics. The introduction of nonnative aquatic species, particularly fish, is also implicated in the decline of native aquatic species. The introduction of nonnative aquatic species into areas outside of their historical range or where they were previously absent has occurred worldwide and is the subject of literature in many countries including the United States (see references to follow), Canada (Van Zyll de Jong et al. 2004), Europe (Cowx and Gerdoux 2004), New Zealand (McDowall 2003), and South America (Macchi et al. 1999). Today, it is widely accepted that the introduction of nonnative fishes can influence native fishes by predation, competition, hybridization and the introduction of diseases or parasites (see for example Robinson et al 1998; Zimmerman 1999; Adams et al. 2001). In addition to these potential interactions, Moyle (2002) described interactions as well as the potential for habitat interference (changes to physical or biological qualities of the habitat due to the actions of the nonnative species). The result of these potential interactions can be the elimination or reduction of native species, reduced growth and survival of native species, changes in the community structure, or no effect or no measurable effect (Moyle et al. 1986). Prior to the 1960s, the implications of these introductions on native aquatic fauna were unknown or not typically considered. However, for many decades now, the impacts of nonnative fish on native aquatic communities is considered and incorporated into management plans.

## Interaction opportunities

The interaction opportunities that may result from the introduction of nonnative fishes including predation, competition, and the introduction of disease and parasites are discussed in this section. Hybridization is discussed in the Background section specific to trout. While it is recognized that habitat interference due to the addition of nonnative fish is a potential impact to native aquatic communities, the dynamics associated with these impacts have focused largely on changes in the food web dynamics in lakes or coastal and estuarine systems after the introduction or removal of top predator nonnative fish species or nonnative molluscs (see for example Elser et al. 1995). In general, it is recognized that fish play a part in regulating food web dynamics and what they consume as well as what they are consumed by also impact the trophic structure and biodiversity of waters. It is important to note that even between species that evolved together, the dynamics of current interactions may not be the same as before habitat alterations occurred. The assumptions of how the native species will interact under current conditions take this into account, while acknowledging the historical context.

Competition.—In order to evaluate the impacts of intra- or inter-specific competition between native aquatic species and stocked nonnative fish, the basic ecology of each species involved must be understood. In general, competition occurs when multiple organisms use common and limited resources. For competitive interactions between salmonids and between species with similar dietary preferences, competition is for habitat space for foraging rather than direct competition for individual foods (Pacificorps 2004). Presumably intraspecific competition between salmonids for limited spawning, foraging, and overwintering habitat may be influential to the growth and survival of individuals because habitat preferences and requirements are the same.

The effects of interspecific competition are difficult to quantify, particularly when species introductions produce a species assemblage which were not naturally sympatric. Baltz and Moyle (1984) found that populations of Sacramento suckers (*Catostomus occidentalis*) and rainbow trout exhibited high resource overlap yet partitioned themselves vertically in the stream, thus minimizing similar microhabitat use. Based on studies conducted in California streams, Baltz and Moyle (1993) postulated that native species assemblages are highly structured and provide resistance to invasions of introduced fishes by their adaptability to fluctuating environmental conditions and the presence of occasionally predacious native fishes that may prey on juvenile introduced fishes. Similar results were found in North Carolina, where the species assemblage and microhabitat use were determined primarily by flow variability rather than interspecific competition for limited resources and predation (Grossman et al. 1998). At a broader scale, species assemblages can also be determined by human induced changes in habitat. For example, Moyle and Nichols (1974) surveyed streams in the Sierra Nevada foothills of California and found that introduced species occurred primarily in disturbed habitats due to dam construction and development, and the range of native fishes moved upstream out of these areas.

To determine the quantifiable impacts of inter- and intra-specific competition, the experimental design of the study must include comparisons between the impacts of adding and/or removing interspecific competing species versus the impact of adding and/or removing intraspecific competitors (Lemly 1985, Fausch 1988). Additional considerations include, but are not limited

to, the plasticity of native and nonnative aquatic species in habitat preferences, timing of overlap, carrying capacity of habitats, available habitat niches, water velocity and temperature variations and adaptations (Baltz and Moyle 1984, Fausch 1988, Baltz and Moyle 1993, Pacificorps 2004). The evidence of competition is rarely quantified and is largely inferential (Moyle 1986). More often, environmental conditions such as drought and flow variations impact the species assemblage by causing mortality and low recruitment (Baltz and Moyle 1993, Grossman et al. 1998). However, it is recognized that competition for limited resources may occur and may be highly variable based on many factors discussed in this section. Although the capacity of habitats to support a particular biomass of fish varies, and other factors influence the actual biomass present (Clarkson and Wilson 1995), the addition of individuals to resident fish populations may result in resource limitation and subsequent competitive interactions.

Predation.— The degree of piscivory in the proposed species for stocking varies substantially. Studies have documented the following ranges of piscivory (in percent of diet), some of which will be discussed in more detail in the Background section: brook trout (0-60%), brown trout (10-60%), cutthroat trout (0-22.5%), rainbow trout (0-8%), channel catfish (0-55%), largemouth bass (15-100%), smallmouth bass (10-100%), and sunfish (10-65%) (Griffith 1974, Cunjak et al. 1987, Mittelbach and Persson 1998, Railsback and Rose 1999, Simpkins and Hubert 2000, L'Abée-Lund et al. 2002, Mistak et al. 2003, Olson and Young 2003, Wheeler and Allen 2003, Fritts and Pearsons 2004, Hilderbrand and Kershner 2004, Naughton et al. 2004, Nowak et al. 2004, Haddix and Budy 2005, Kawaguchi et al. 2007, Tabor et al. 2007). The effects of nonnative fish predation on native fish may impact the population structure of native fish and this largely depends on the degree of piscivory in nonnative fish, as well as several other factors, including: species assemblage and prey base, and competition among top predators (Lemly 1985).

Nonnative aquatic species vary in the type and degree of potential interactions they have with native aquatic species. Some nonnative aquatic species are more piscivorous than others; some are more aggressive and are better competitors for space. Individuals of the two species must, at some time, be in the same place (occupy or use the same water or specific habitats within that water), be in competition for resources (food or habitat), or, for direct predatory interactions, also be available at the right size for the predation attempt. There may be seasonal dynamics that determine when an interaction may occur based on when the nonnative aquatic species is present and the life stage and vulnerability of available prey.

### *Diseases and Parasites*

#### *Potential to spread pathogens by the AGFD fish stocking program*

The potential risk of spreading pathogens through the AGFD hatchery stocking program has been rigorously evaluated by the AGFD in conjunction with the USFWS and it is greatly reduced through recurrent fish health inspections and strict Hazard Analysis and Critical Control Point planning (HACCP). Based on current knowledge, all pathogens that have been found in Arizona hatcheries have also been found in wild populations in Arizona waters (Table 13), making it less likely that novel pathogens will be introduced into Arizona waters. Also, evidence indicates that a greater number of pathogens have been found in wild fish than in fish within Arizona hatcheries, even though disease testing occurs more frequently at hatcheries (Table 13). Amos

and Thomas (2002) found a greater risk of disease transmission from wild fish to hatchery fish, than from hatchery fish to wild fish. This is perhaps due to the conditions created by the intensive culture of hatchery fish, making them more prone to infections. In wild fish populations, lower fish densities confer some safeguards regarding transmission. Also, wild fish are less stressed and may have stronger and more natural immune systems compared to hatchery-raised fish.

To prevent the spread of pathogens, the AGFD follows the same protocols for fish health inspection as the USFWS National Fish Hatcheries and the USFWS Fish Health Centers: the American Fisheries Society Fish Health Section Blue Book co-authored by the USFWS (AFS-USFWS 2007). This handbook reflects the combined efforts and expertise of the USFWS Fish Health Centers and the American Fisheries Society Fish Health Section. It has been assembled by a vast array of individuals with academic and field expertise. It is a compilation of methodologies determined to be most appropriate for detecting the presence of specific pathogens during an aquatic animal health inspection. The methodologies are based on numerous sources, including the USFWS National Wild Fish Health Survey Manual, the American Fisheries Society Blue Book, 5th edition of the Office International des Epizooties (OIE) Manual of Diagnostic Tests for Aquatic Animals, Alaska Department of Fish and Game, Fish Pathology Section Laboratory Manual, and peer reviewed literature.

The AGFD HACCP plan complies with international standard (ASTM E2590 - 09) for reducing or eliminating the spread of unwanted species. The HACCP was developed as an effective planning tool for creating best management practices to prevent the spread of non-target species. The USFWS, AGFD and State of Wyoming Game and Fish Department worked together to develop the HACCP Planning for Natural Resource Pathways manual keyed to the operations and activities associated with natural resource management and aquatic resource propagation (USFWS 2004). This tool provides a comprehensive method to identify risks and focus procedures to prevent the spread of species through natural resource pathways.

There are specific concerns that the AGFD hatchery stocking program may spread the amphibian disease *Bd*. This risk has been assessed and found to be very low due to the life cycle of *Bd* (Berger et al. 2005) and the precautions taken in the AGFD HACCP plan. The life cycle of *Bd* is a progression from a zoospore to the growing organism called a thallus. The thallus contains a zoosporangium which functions as a container for zoospores. The zoosporangium cleaves into multiple zoospores that exit the zoosporangium through papillae. The motile zoospores attach to the keratinised outer layers of its amphibian host. Zoospores mature into zoosporangia that then release zoospores into the external environment. The cycle is initiated again once a suitable substrate (in the same or a different host) is found. This particular case of spreading *Bd* is one that relies on the following series of events to occur that would lead to amphibians being infected by *Bd* in areas where the disease does not already exist. Specifically: 1) a hatchery would have to be infected with *Bd*; 2) zoospores contained in water from an infected hatchery would have to survive control points and treatments called for in the HACCP plan (See Chapter 1); 3) zoospores would then have to survive the trip in the hatchery truck to the stocking site; 4) zoospores would have to survive in stocking area long enough to encounter an amphibian host; and 5) the amphibian host would have to become infected and then spread the infection to other amphibians.

**Table 13. Pathogens that are found in wild fish in Arizona waters. Also noted is their occurrence in Arizona hatcheries.**

| <b>Pathogen</b>                      | <b>Type</b> | <b>Found in Arizona Hatcheries (Y/N)</b> |
|--------------------------------------|-------------|------------------------------------------|
| Saprolegnia sp.                      | Fungal      | Y                                        |
| <i>Lernaea cyprinacea</i>            | Parasitic   | Y                                        |
| Cestodes                             | Parasitic   | Y                                        |
| Ichthyophthirius multifiliis         | Parasitic   | Y                                        |
| Ichthyobodo necator                  | Parasitic   | Y                                        |
| Ambiphrya sp.                        | Parasitic   | Y                                        |
| Trichodina sp.                       | Parasitic   | Y                                        |
| Gyrodactylus sp.                     | Parasitic   | Y                                        |
| Dactylogyrus sp.                     | Parasitic   | Y                                        |
| Hexamita                             | Parasitic   | Y                                        |
| <i>Clinostomum</i> sp.               | Parasitic   | N                                        |
| <i>Posthodiplostomum</i> sp.         | Parasitic   | N                                        |
| Urilifer sp.                         | Parasitic   | N                                        |
| Leaches                              | Parasitic   | N                                        |
| Nematodes                            | Parasitic   | N                                        |
| Myxobolus cerebralis                 | Parasitic   | N                                        |
| Flavobacterium psychrophilus         | Bacterial   | Y                                        |
| Flavobacterium sp.                   | Bacterial   | Y                                        |
| Flavobacterium columnare             | Bacterial   | Y                                        |
| Yersinia ruckeri                     | Bacterial   | Y                                        |
| Aeromonas salmonicida                | Bacterial   | Y                                        |
| Renibacterium salmoninarum           | Bacterial   | N                                        |
| Aeromonas hydrophilla                | Bacterial   | N                                        |
| Cyprinid herpesvirus-3               | Viral       | N                                        |
| Unspecified reovirus                 | Viral       | N                                        |
| Infectious Pancreatic Necrosis Virus | Viral       | Y                                        |

The only known occurrence and tests for *Bd* in the AGFD hatchery system is in bullfrogs found in the ponds at the BPFH. Trout are not raised in these ponds; trout are raised near Bubbling Ponds at the Page Springs Hatchery. Page Springs Hatchery has separate water sources (Pond Spring and Cave Spring). Another consideration is that trout are raised in raceways and do not come in contact with frogs and therefore are unlikely to come into contact with *Bd*.

### ***Fish Species Proposed for Stocking***

This section addresses currently proposed sport fish stockings in Arizona, by species (Table 14), and discusses potential interactions and impacts stocked fish may have on Federally listed, candidate or proposed native fish and other native aquatic species. A thorough background on proposed stocking species that exhibit varying degrees of piscivory is presented as well as

survivability of stocked species, if sufficient background information was available. The following will be addressed for native fish:

- Impacts related to documented competition and/or predation between stocked and native fish (predation is discussed for stocked species with documented piscivory only);
- Impacts of hybridization between stocked and native salmonids.

**Table 14. Fish species proposed for stocking into Arizona waters. A \* indicates a native fish species. The nonnative fish species proposed for stocking under this program are all currently found in Arizona.**

| Group     | Species                                                                                                  |
|-----------|----------------------------------------------------------------------------------------------------------|
| Salmonids | Rainbow trout, brown trout, brook trout, cutthroat trout, Arctic grayling, Apache trout* and Gila trout* |
| Bass      | Largemouth bass, smallmouth bass                                                                         |
| Sunfish   | Bluegill, redear sunfish, black crappie, white crappie                                                   |
| Catfish   | Channel catfish                                                                                          |
| Carp      | Triploid Grass carp (white amur)                                                                         |
| Other     | Walleye, yellow perch, threadfin shad                                                                    |

Proposed stocking species: black basses (largemouth bass and smallmouth bass)

### History of stocked black basses

Stockings of other nonnative fishes occurred throughout the United States to diversify angling experiences in warmer waters. Centrarchids, native to North America east of the Rocky Mountains, have been widely introduced throughout the eastern and western United States. In Arizona, black basses were introduced in the late 1800s (Sublette et al. 1990).

### Survivability of stocked black basses

It is difficult to estimate the post-stocking survivability of stocked basses, primarily because they are predominately stocked into large lakes and reservoirs (Buynak et al. 1999). The annual mortality of adult largemouth bass in the Lucchetti Reservoir in Puerto Rico may be greater than 50% and mortality from angling approximately 28% (Neal and Noble 2002). A meta-analysis of largemouth bass and smallmouth bass populations in North America revealed average annual natural mortality rates at 35% and annual angler harvest rates for the average population were over 30% (Beamesderfer and North 1995). Poor survival of subadult largemouth bass stocked into Carr Creek Lake, Kentucky, was observed and determined to result primarily from illegal harvest and stress from catch-and-release angling (Buynak et al. 1999). Low long-term survival was documented for various sizes of largemouth bass fingerlings stocked into Illinois reservoirs and was greatly influenced by predation by resident piscivores, predominately adult largemouth bass (Diana and Wahl 2009). Considering the high natural mortality rates of stocked bass, fish are typically stocked in high numbers to establish sport fisheries.

### Competition between black basses and native fish



Where largemouth bass persist, they are likely to be top predators. They prefer warmer streams and lakes with lower turbidity and beds of aquatic vegetation (Sublette et al. 1990, Moyle 2002, Bryan et al. 2000). Pacey and Marsh (1998) reported no data to support largemouth bass occupying higher velocity stream habitats in Arizona (e.g., riffles, runs, glides, eddies). In streams in the Sierra Nevada foothills of California, largemouth bass were found primarily in habitats disturbed by humans (e.g., dams, silt, irrigation diversions) and preferred warm, turbid pools (Moyle and Nichols 1973). Species diversity was high in areas where largemouth bass occurred, with an assemblage including mosquitofish, sunfish, bluegill, shiners, catfish, and carp. Largemouth bass, among other introduced fish, were less common in areas dominated by native fish. Native fishes were located in areas upstream, most likely displaced by a combination of habitat disturbance, water quality, and the presence of introduced fishes.

Little information exists regarding competition between black bass and native fishes; most information focuses on the impacts of predation of black bass on native fishes. However, competition and predation among top predators such as black bass, walleye, and northern pike in lake systems have been evaluated (see for example, Fayram et al. 2005). For example, some studies in lacustrine habitats have found that predation on walleye by largemouth bass was the primary limiting factor for walleye production and survival (Fayram et al. 2005). Thus, competition is possible between black bass and other top predator native fish in areas where they co-exist and resources are limited. Given the aggressive nature of black basses, displacement and/or competition between bass and native fish is possible if there is any overlap in diet or habitat.

### **Piscivory in black basses**

Both largemouth and smallmouth basses are highly piscivorous at juvenile and adult ages. Largemouth bass larvae feed on zooplankton and switch to macrobenthos, and become piscivorous at 38-100 mm (Sublette et al. 1990, Mittelbach and Persson 1998). Adults may feed on a variety of organisms including insects, crayfish, frogs, snails, small mammals, reptiles, young waterfowl and other fishes (Sublette et al. 1990, Pacey and Marsh 1998). Bonar et al. (2004) considered largemouth bass to be the most significant piscivore in the Verde River with almost 17% ( $n = 1109$ ) of the diet consisting of fish (8.3% native fish, 6.2% nonnative fish, 2% unknown fish). Other studies have documented piscivory rates in largemouth bass to range between 15-100%, varying by size and location (Mittelbach and Persson 1998, Olson and Young 2003, Wheeler and Allen 2003, Tabor et al 2007).

Young smallmouth bass feed on plankton, immature aquatic insects, and fish while adults take in crayfish, fish, and aquatic and terrestrial insects in lakes and streams. In streams, smallmouth bass can be very aggressive when hellgrammites and terrestrial insects are available. Once the bass reaches 200 mm in length, the diet may become nearly exclusively piscivorous when sufficient prey are present (Sublette et al. 1990, Moyle 2002) and crayfish have been found to dominate the diets of adults when abundant as well (41-79% fish, 13-58% crayfish; (Fayram and Sibley 2000). Piscivory rates for smallmouth bass have been documented to range between 3.4-100%, with rates varying by size, season, and location (Mittelbach and Persson 1998, Olson and Young 2003, Bonar et al 2004, Fritts and Pearsons 2004, Naughton et al 2004). Bonar et al. (2004) documented piscivory rates in smallmouth bass in the Verde River to be less than 4% ( $n =$



1441) and most fish consumed were nonnative fish (2.8% nonnative, 0.7% native, 0.7% unknown). In the Columbia River, smallmouth bass diets were dominated by fish (70-83%) or crayfish (52%) during spring and summer, varying by location (Zimmerman 1999). Smallmouth bass consumed both native and introduced fish, but preferred native sculpins, suckers, and salmonids.

Proposed stocking species: Channel catfish

### **History of stocked channel catfish**

Channel catfish, native to central North America and southern Canada, were introduced into warm water habitats in Arizona beginning in 1878.

### **Piscivory in channel catfish**

There was insufficient information available in the literature on the survivability of channel catfish and competitive interactions with native fish. However, competition, including displacement, can occur with native fish where resources are limited and species co-occur. Channel catfish feed primarily on macroinvertebrates as well as plants, crayfish, and fish. In Missouri, the use of foods other than macroinvertebrates tended to increase when catfish reached larger sizes (Michaletz 2006). The channel catfish diet was dominated by macroinvertebrates until fish size was greater than 550 mm or 650 mm, depending on the lake. Consumption of fish and crayfish increased with size and the highest piscivory rates were in channel catfish over 550 mm (10-35% of diet). Crayfish consumption was most substantial in fish greater than 650 mm (range 20-40% of diet). Piscivory in smaller channel catfish was much lower, ranging from 0-5% in fish 250-349 mm, about 3-10% in fish 350-449 mm, and about 10-15% in fish 450-549 mm. Chironomids were the most commonly consumed macroinvertebrate (52% of diet) with mayflies and caddisflies contributing to 12% of the diets. This study also found that plant materials and fish increased in the diet as the size of the catfish increased (>400 mm).

In Arizona, channel catfish and flathead catfish were documented to prey upon newly stocked juvenile razorback suckers, with 55% and 90% of diets consisting of suckers post-stocking, respectively (Marsh and Brooks 1989). Prior to stocking, flathead catfish fed primarily on red shiner and channel catfish, and channel catfish observed an omnivorous diet with both fish and insect prey consumed.

Proposed stocking species: sunfish (bluegill, redear sunfish, black crappie, white crappie)

### **History of stocked sunfishes**

To diversify angling experiences in warmer waters, eventually stockings of other nonnative fishes occurred throughout the United States. Centrarchids, native to North America east of the Rocky Mountains, have been widely introduced throughout the eastern and western United States. In Arizona, bluegill were first stocked in 1932, crappie in 1905, and redear sunfish in 1946 (Sublette et al. 1990).

### **Survivability of stocked sunfishes**

There is little information available in the published literature on the post-stocking survival of sunfish reared in hatcheries; most literature on survival documents natural populations, primarily in lacustrine habitats. In general, sunfishes are considered short-lived, fast-growing fish with low natural survival rates (Sammons and Maceina 2008). In Georgia rivers bluegill lived for up to 7 years and annual mortality ranged between 66-79%. Redear sunfish reached a maximum of 10 years and annual mortality ranged between 40-42%. In Lake Panasoffkee, Florida, annual mortality rates for bluegill and redear sunfish were 64% and 68%, respectively, 50-55% of which were from natural mortality and the remainder from angler exploitation (Crawford and Allen 2006). Black crappie survival in Georgia reservoirs ranged between 8-18% and angler exploitation rates ranged between 40-68% (Larson et al. 1991).

Survival of bluegill may depend on whether or not they co-exist with piscivores. Bluegill are known to have high survival rates in the absence of piscivores, but are an important prey fish in waters containing piscivores such as largemouth bass, which would impact bluegill survival and recruitment (Gabelhouse 1987, Santucci and Wahl 2003). For example, predation by largemouth bass on larval bluegill produced a 13% mortality rate, while predation on juvenile bluegill produced a mortality rate between 58-93%; natural mortality was estimated at 87-97% for larval bluegill and less than 10% for juvenile bluegill (Santucci and Wahl 2003).

Establishment of reproducing populations for sport fishing in Arizona is only done in lakes and ponds, not streams or rivers. Optimal riverine habitat for bluegills is characterized by the following conditions, assuming water quality is adequate: large, low gradient streams (<0.5 m/km); warm water temperatures (> 20° C); sluggish current velocities (<5cm/sec); clear water (<50 ppm suspended solids); and an abundance of bottom cover within pool areas (Stuber et al. 1982a). Bluegill are not abundant or widespread in most small or medium stream systems because of the limited habitat suitability.

### **Competition between sunfish and native fish**

There is limited information published on the dynamics of competition between introduced sunfish and native fish. One study documented native fish (e.g., sunfish, darters, perch, pickerel, eel) abundances with small ranges in the New Jersey Pinelands were significantly higher in impoundments absent of introduced centrarchids (black crappie, bluegill, and largemouth bass; Bunnell and Zampella 2008). The impoundments supporting introduced centrarchids were generally considered degraded habitats, which may have been less suitable for native fish, resulting in fewer fish. Predation and competition among native fish and introduced centrarchids likely occurred, yet impacts to native fish by largemouth bass were likely more severe than impacts from black crappie and bluegill (Bonar et al. 2004).

### **Piscivory in sunfish**

Bluegill.—Eagles-Smith et al. (2008) observed bluegill in Clear Lake, California, less than 45 mm to consume both pelagic and benthic insect prey, and fish greater than 45 mm fed primarily

on benthos; bluegill were not observed to feed on fish. Crayfish, fish, zooplankton, and aquatic vegetation may also be consumed by bluegill in particular habitats (Seaburg and Moyle 1964; Sigler and Sigler 1987, Sublette et al. 1990). For example, bluegill diets in two Minnesota lakes varied between lakes; bluegill consumed primarily insects (60%) and plants (21%) and were not piscivorous in Maple Lake, while bluegill in Grove Lake consumed fish (6%), insects (40%), and crustaceans (19%; Seaburg and Moyle 1964). Bluegill in two Washington lakes consumed primarily invertebrates and less than 1% of diets consisted of fish (Bonar et al. 2005). Similarly, bluegill in two Missouri lakes consumed primarily macroinvertebrates and did not exhibit piscivory (Michaletz 2006). Bonar et al. (2004) considered bluegill to be primarily insectivorous in the Verde River; fish accounted for a small portion of bluegill diets (less than 4%) and bluegill were not considered to have a significant predatory impact on native fish populations. Minckley (1973) observed bluegill diets to consist of primarily zooplankton and aquatic insects, and occasionally very small fishes (threadfin shad and other sunfishes). In coastal Mississippi waters, bluegill consumed primarily insect larvae, copepods, and amphipods, and consumed larger insects at larger sizes. Fish were not found in the diets of either bluegill or redear sunfish. Similar results were documented for redear and bluegill in Lake Pontchartrain, Louisiana (Desselle et al. 1978).

Redear sunfish.—These sunfish primarily feed on benthic organisms (insect larvae, insects, snails, amphipods) and have evolved specialized muscles and molars for crushing mollusc shells (Lauder 1983; Moyle 2002). The diets of redear sunfish from Lake Roosevelt consisted primarily of planktonic crustaceans, insect larvae, and small clams (Minckley 1973). Redear sunfish consumed insect larvae, larger insects, amphipods and molluscs (Peterson et al. 2006). Fish were not found in the diets of either bluegill or redear sunfish. Similar results were documented for redear and bluegill in Lake Pontchartrain, Louisiana (Desselle et al. 1978).

Black and white crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey more on fishes as they mature (Moyle 2002). In two Minnesota lakes, the dominating prey in black crappie diets varied between lakes (Seaburg and Moyle 1964). Black crappie fed primarily on fish (60%) and insects (36%) at Maple Lake and fed primarily on insects (49%), fish (23%), and crustaceans (12%) in Grove Lake. In Washington lakes, black crappie fed primarily on invertebrates (70-89%) and fish (8-27%; Bonar et al. 2005). Sublette et al. (1990) described adult black crappies as mid-water carnivores, feeding on insects, crustaceans, other invertebrates, and small fish. They may prefer fish, insects, and crustaceans as adults, and planktonic crustaceans and larval insects as juveniles (Minckley 1973, Moyle 2002). Minckley (1973) stated that in Arizona, when they achieve 100 mm in length they feed almost entirely to threadfin shad where the species co-occur. White crappie are similar to black crappie, and are often difficult to distinguish, particularly at small sizes (Minckley 1973). In Kansas reservoirs, white crappie consumed primarily diptera larvae; however, 53% of crappie also consumed juvenile walleye (Quist et al. 2003).

Proposed stocking species: trout and grayling

### **History of stocked trout**

In the western United States from the late 1800s up to the mid 1960s, millions of trout were

stocked into lakes and streams to enhance sport fishing opportunities (Pister 2001). The stockings of primarily salmonids were made by miners, cattlemen, sportsman groups, private individuals, and eventually government agencies. Rainbow trout and brook trout, both native to North America, were stocked in streams and lakes outside of their native ranges. Early rainbow trout stockings were most likely with fish from numerous California hatcheries (California Department of Fish and Game [CDFG] 2009) and brook trout were transported from the eastern United States. Brown trout were first brought to North America in the late 1800s and subsequently stocked into lakes and rivers across the country. Eventually states began raising nonnative salmonids in state-run hatcheries and produced fish were stocked into waters within each state. In western states in the late 1950s and early 1960s, it was not uncommon for fisheries management activities to include chemically treating waters to reduce nongame fish abundance to favor game fish abundance (see for example, Moyle et al. 1983). In Arizona, rainbow, brook, brown, and cutthroat trouts, arctic grayling, and coho salmon have been stocked historically.

### **Survivability of stocked trout**

Most hatchery rainbow trout stocked into put-and-take fisheries in streams are caught within a few weeks (Butler and Borgeson 1965, Fay and Pardue 1986, Barnes et al. 2009, CDFG 2009). This subject has been widely investigated for rainbow, brown, and brook trouts since the 1940s when fishery managers sought to increase survivability of stocked trout to meet angler demands (see for example: Chamberlain 1943, Miller 1954, Reimers 1963). For example, 50% of hatchery-raised brown trout stocked into Norway streams were caught within 15 days, and 90% within 67 days (Skurdal et al. 1989). In the Pigeon River, Michigan, survival of stocked hatchery rainbow, brown, and brook trouts was 22%, 26%, and 4%, respectively, 40 days post-stocking (Cooper 1953). Fewer than 10% of stocked rainbow and brown trout and less than 3% of stocked brook trout survived to overwinter. Survival of stocked hatchery-reared cutthroat trout and transplanted wild cutthroat trout, both stocked during the summer, were compared in Gorge Creek, Alberta (Miller 1954). Hatchery trout survival from summer to one winter ranged between 3 – 15% and wild transplanted trout survival was 62%. The majority of rainbow trout stocked into Convict Creek, California, were caught within the first few weeks post stocking and a small number of fish survived to overwinter (Reimers 1963). However, the majority of surviving fish died during the winter due to low condition factors at the end of the summer. These results are typical based on the results of other studies and indicate that stocked trout are generally either angled or experience natural mortality soon after stocking (Bachman 1984, Skurdal et al. 1989). Overwinter mortality may also be higher for stocked trout that survive the summer creel compared with resident trout (Meyer 1995, Simpkins and Hubert 2000).

One study in Arizona estimated post-stocking survival of catchable-size hatchery-reared native Apache trout and found that 34% of stocked trout survived three months post-stocking, however only 3% survived nine months post-stocking (Meyer 1995). Hatchery-reared brook trout stocked in Wisconsin streams during the fall, a domestic strain for 30 years, had survival rates at 6-months post-stocking between 33 – 49% and less than 1.5% survived for one year post-stocking (Mason et al. 1967). In lakes, survivability of stocked trout is typically higher depending on the sport fishery (e.g., put-and-take, put-grow-take) and can range from 3-5 years (Haddix and Budy 2005, CDFG 2009). Studies conducted in 2006 in an Idaho River show that stocked triploid trout do not persist long in the stream, some of the mortality is likely due to angler harvest, however

much is likely due to poor survival of stocked trout in stream environments (High and Meyer 2009). In this same study post stocking dispersal (30 days) was generally downstream of the stocking point with median movement values of maximum known downstream and upstream dispersal distance being 5.0 and 1.2km from the stocking point respectively.

In general, the high natural mortality rate observed in stocked trout is suggested to result from a combination of the following: stocked trout are poorly adapted to stream environments, competition with resident trout populations, high stocking densities, warming water temperatures, foraging techniques and natural feed, appropriate energy expenditures, and seasonal dominance hierarchies associated with drift feeding and territory establishment (Bachman 1984, Runge et al. 2008). For example, domestication and naivety may influence trout survival in streams by constant feed and/or overfeeding, lack of exercise, constant temperatures, absence of predators, and transport stress (Schuck 1948, CDFG 2009). In addition, habitat suitability also plays a strong part in the survivability of stocked trout (Montgomery and Bernstein 2008). Stand alone or combined, these adaptations may result in malnutrition and subsequent mortality. In a study examining the interactions between stocked greenback cutthroat trout (*Oncorhynchus clarki stomias*) and wild brown trout, cutthroat trout were typically displaced by brown trout and were at a competitive disadvantage for food and space (Wang and White 1994). In a separate study, cutthroat trout *in situ* in a linear foraging hierarchy set up with the dominant fish at the front and intermediate and subordinate fish behind. The dominant trout will have a foraging advantage because it can catch the most optimal invertebrates in the drift first (Lewynsky and Bjornn 1986). Foraging dominance hierarchies have also been documented for other salmonids including rainbow trout, brown trout, brook trout, and coho salmon (*O. kisutch*) (Jenkins 1969, Fausch 1984). It is postulated that trout stocked into a stream with previously established resident trout would not be able to establish a superior foraging position and would also be at an aggressive disadvantage (Jenkins 1969).

Based on information presented in the studies cited above, the survivability of hatchery-reared stocked trout in streams is low, regardless of the species, and a number of factors involved in hatchery methods may play a part. For put-and-take fisheries, most trout are harvested immediately to within a few weeks after stocking, so streams may be stocked multiple times throughout a season in a concentrated area to maintain acceptable catch rates. The frequency of stocking is dependent on many factors including the anticipated angling demand, recreational use potential of certain locations, existing fish populations, availability of trout, and the physical, chemical, and biological characteristics of the location receiving fish. Stocking frequency ranges from weekly to monthly, and the duration of the season largely depends on the temperature regime for individual streams and angler accessibility or use. Because survival of stocked trout is usually limited by summer water temperatures and overwintering success, harvest of trout in these waters is generally encouraged. Regulations typically permit the harvest of six trout per day with no size restrictions.

When trout are stocked at high densities multiple times a year, there may be a pulse effect where stocked trout are abundant for a short time before the majority of fish are harvested or die. The duration of the pulse events is highly variable depending on the number of fish stocked, angling pressure, fishing mortality (harvest and catch related), natural mortality, stocking season duration, and the number of stockings that occur. A thorough review of the literature did not find

publications that addressed the potential impacts of multiple trout stockings on native fish populations in the stocking locations. Thus, the competitive and predatory interactions discussed below are assumed to apply to these stocking strategies for put-and-take fisheries. It is acknowledged that there may be multiple stressors impacting any given fish population and that the additive impacts of put and take rainbow trout stocking may or may not have a significant impact on the persistence of native fish populations. The presence of wild and self-sustaining nonnative trout populations in Arizona is evidence that some stocked fish may survive, evade harvest and establish populations. Many of these existing trout populations were stocked earlier in Arizona's history and may have come from many different sources such as from hatcheries as adults, from hatcheries as juveniles, from wild trout transported directly from the natal stream to the Arizona stream as larvae, juveniles or adults or other vectors. Many of these populations may have first been established in remote first and second order streams that experience limiting fishing pressure; however, once established there, they spread into other suitable habitats. With regard to rainbow trout, the transition of the stocking program to raising triploid, non-reproducing fish greatly reduces the opportunity for their stocking to result in establishment of new populations or augmentation of existing populations.

### **Competition between stocked trout and native fish**

Competition for space between stocked trout and native or nonnative salmonids has been documented in several studies and may depend on a multitude of factors including prey availability, diet niches, territorial behavior, naivety, growth, and habitat conditions and preferences (Fausch 1988, DeWald and Wilzbach 1992, Wang and White 1994, Shemai et al. 2007, Öhlund et al. 2008). For example, one study determined there was significant overlap between the insectivorous diets of native Bonneville cutthroat trout (*O. c. Utah*) and nonnative brook trout in Idaho, but did not document any indication of competition that may result in different length/weight relationships (Hilderbrand and Kershner 2004). However, they noted that if food was a limiting resource there may be competition between the species. In contrast, a study examining competition between hatchery Rio Grande cutthroat trout (*O. c. virginalis*) and resident brown trout in New Mexico found that cutthroat trout lost weight and fed less in the presence of brown trout (Shemai et al. 2007). Another study examining the success of stocked hatchery brook trout on resident brown trout found that brook trout exhibited poor survival as evidenced by lack of feeding success or inefficient feeding ability (Ersbak and Haase 1983). At the time of stocking, the condition factors of brook trout were significantly higher than for resident brown trout. The condition factor in brook trout declined significantly within two weeks of stocking; brown trout consumed significantly more prey and greater volumes of prey. After 2 weeks the condition factors between brown and brook trout were similar, however, brown trout continued to consume more prey and the condition factor of brook trout continued to decrease. Displacement of native salmonids due to the presence of nonnative salmonids has been widely documented and is highly variable (see for example, Larson et al 1995, McHugh and Budy 2006). For example, some studies indicate that native stream-dwelling salmonids occupy headwater reaches more frequently than nonnative salmonids (Larson et al. 1995, Dunham et al. 1999, Paul and Post 2001). Paul and Post (2001) suggested the elevation gradient of trout occurrence to be a result of interspecific competition, angling harvest, and/or original stocking location. Native salmonids may be competitively superior at higher elevations and nonnative salmonids superior at lower elevation reaches. A study of potential displacement of native

greenback cutthroat trout by nonnative brook trout determined that brook trout competitively influenced the recruitment of age-0 cutthroat trout; however, brook trout did not displace cutthroat trout at any other life stage when living in sympatry (McGrath and Lewis 2007). Strange and Habera (1998) determined that the range of native brook trout was not impacted by sympatric populations of rainbow trout and that the fluctuations in the numbers of both species over time was due to interactions of biotic and abiotic factors.

Interspecific competition has been documented for the relationship between native and nonnative salmonids (see references above), however, there is less information available on the competitive impacts of stocked trout on non-salmonid native fish. The impacts of resident nonnative trout on native galaxiids in New Zealand have been documented and include predation and exploitative competition for prey (McDowall 2003). Changes in habitat use have been documented in some studies examining the impact of nonnative salmonids on native small-bodied fishes. For example, Blinn et al. (1993) found that Little Colorado spinedace used undercut banks more frequently when rainbow trout were absent, and spinedace were less abundant in habitats shared with resident rainbow trout populations (Blinn and Runck 1990). Due to temperature tolerances of trout, competitive interactions between stocked trout and other native fishes may be weakened in warm waters (Montgomery and Bernstein 2008).

Propst et al. (1998) studied the interactions between nonnative stocked rainbow trout and native cyprinids (e.g., loach minnow, spinedace) and native suckers in the Gila River, New Mexico. At three study sites where rainbow trout were regularly stocked, a small number of hatchery rainbow trout were captured and native fishes were the most abundant. At two out of the three study sites, evidence of piscivory by hatchery rainbow trout on native fish was low (1/13 [8%] site 1; 1/11 [9%] site 2). Rainbow trout were found occupying different habitat than loach minnow and spinedace; trout were found most commonly in pools compared with the more common presence of native cyprinids in riffles. The authors concluded that the persistence of hatchery trout was low and predation on native fish was low, which likely reduced any negative impacts on native fish populations. A long-term study in the Gila River determined that the decline of native fishes was influenced by many factors (Propst et al. 2008). In one study reach, the decrease in native fishes was due to the increase in nonnative predacious fish including largemouth bass and yellow bullhead, and modified flow regimes. In another study reach where trout were consistently stocked until 1996, the decline in native fishes was not attributed to predation by stocked trout, but from impacts of drought and wildfire. Stocked trout in one study reach were implicated as a reason for decline of native fishes in that reach, and stocking was ceased in 1996. Thus, results were highly variable and dependent upon many factors.

### **Piscivory in Apache trout, rainbow trout, cutthroat trout, and Arctic grayling**

Wild rainbow and cutthroat trout, not including steelhead or coastal populations of either species, are opportunistic feeders that primarily consume aquatic and terrestrial insects (diets consisted of invertebrates only: see for example, Railsback and Rose 1999, Simpkins and Hubert 2000, Hilderbrand and Kershner 2004, Kawaguchi et al. 2007). However, evidence of piscivory in rainbow and cutthroat trout has been documented at varying levels and piscivory is demonstrated more frequently in lacustrine habitats compared with fluvial habitats. For example, Hubert et al. (1994) found evidence of piscivory in 1.5% of stocked rainbow trout from Lake DeSmet,

Wyoming. Stocked rainbow trout in Flaming Gorge Reservoir, Utah, primarily consumed macroinvertebrates and only switched to limited piscivory at large sizes that accounted for 2.5 - 8% of trout diets (Haddix and Budy 2005). Elser et al. (1995) documented piscivory in 1% of rainbow trout ( $n = 4/400$ ) in Castle Lake, California. In contrast, evidence of piscivory in native populations of cutthroat trout in Lake Washington, Washington, was found in 22.5% of trout less than 200 mm and in 95% of trout greater than 400 mm (Nowak et al. 2004).

In stream systems, stocked and resident cutthroat trout are less likely to consume significant amounts of fish compared with trout in lacustrine habitats (Young et al 1997, McGrath and Lewis 2007). For example, an investigation into the predation and competition between native greenback cutthroat trout and nonnative brook trout in Colorado streams revealed that 0.3% ( $n = 1/323$ ) of brook trout contained fish in stomach contents and 2.9% ( $n = 3/136$ ) of greenback cutthroat trout contained fish in stomach contents (McGrath and Lewis 2007). The majority of prey fish in the stomach contents of both species were cutthroat trout. The dominant stomach contents for both species were aquatic and terrestrial invertebrates. Native Colorado River cutthroat trout (*O. c. pleuriticus*) in the North Fork Little Snake River, Wyoming, exhibited no piscivory in their diets (Young et al. 1997). In four Idaho streams, resident populations of nonnative brook and native cutthroat trout fed predominantly on aquatic or terrestrial insects and piscivory was rare (0.009% in cutthroat trout, 0.010% in brook trout; Griffith 1974). Similarly, cutthroat trout in the Logan River, Utah, were predominately insectivorous and fish were rarely consumed (0.006%; Fleener 1952).

Rainbow trout in stream systems may also exhibit rare piscivory. For example, rainbow trout in the Green River, Utah, were primarily insectivorous and piscivory was rarely documented (0.004%;  $n = 2/478$ ; Filbert and Hawkins 1995). Documentation of piscivory in rainbow trout in Arizona and New Mexico streams has ranged between 4-9%, with diets primarily consisting of invertebrates (Propst et al. 1998, Robinson et al. 2000, Bonar et al. 2004). Sweetser et al. (2002) found this species was least piscivorous of the three trout species (brown, brook, rainbow) they examined in the Little Colorado River in Arizona. Blinn et al. (1993) documented high rates of piscivory by resident rainbow trout feeding on Little Colorado spinedace (*Lepidomeda vittata*), a threatened native cyprinid, when trout and spinedace were monitored in 2 m x 3 m sections of Nutrioso Creek isolated with nets. The high piscivory rate exhibited may mimic the response of rainbow trout feeding behavior during periods of isolation due to drought, with a high number of smaller bodied fishes in the same isolated habitat.

Piscivory in Apache trout *in situ* has not been documented in stream systems.

Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Jones et al. 2003, Sheuerell et al. 2007). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996).

### **Piscivory in brown trout and brook trout**

Piscivory in brook trout is typically documented at higher rates than rainbow trout and cutthroat trout; however, this is highly variable. For example, two populations of native brook trout in



West Virginia exhibited no piscivory, and fed on aquatic and terrestrial invertebrates (Sweka and Hartman 2008). Two studies cited above (Griffith 1974, McGrath and Lewis 2007) found piscivory to be rare in nonnative brook trout. Similarly, the diets of rainbow, brown, and brook trout in the Pine River, Michigan, were predominately insectivorous and combined piscivory was less than 3% for all three species (Mistak et al. 2003). A study of the winter diet of brook trout in three Ontario streams found fish to represent less than 10% of the diet composition in brook trout from only one of the three streams (Cunjak et al. 1987). In contrast, fish constituted a large part of the brook trout diet in seven lakes in Ontario (Fraser 1981). As stated above, brook trout feed primarily on macroinvertebrates, but may also exhibit piscivory of varying degrees.

A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Brown trout are known to be generalists, and their diets may fluctuate between invertebrates and fish depending on prey availability and size of brown trout (Jonsson et al 1999, Jensen et al 2008). Their piscivorous behavior, as well as its plasticity, is well documented (e.g., Tabor and Wurtsbaugh 1991; L'Abée-Lund et al. 2002). For example, a long-term study of brown trout in the Tunhovdfjord reservoir in Norway documented piscivory in trout to fluctuate between 10% and 60%, depending on the fluctuating populations of two prey species (L'Abée-Lund et al. 2002). One study in eastern Arizona documented piscivory in rainbow trout (6%,  $n = 3/54$ ), brook trout (25%,  $n = 1/4$ ), and brown trout (33%,  $n = 7/24$ ); one brown trout captured had consumed one Little Colorado spinedace (Sweetser et al. 2002). Conversely, resident brown trout in the Arkansas River, Colorado, exhibited no piscivory and consumed primarily macroinvertebrates (Clements and Rees 1997).

Similar to brook trout, studies have found the diets of brown trout to vary significantly (Mittelbach and Persson 1998) and piscivorous behavior is apparently more common in lacustrine habitats and for larger trout (e.g., Macchi et al. 1999, Belica 2007). In Arizona, brown trout are proposed for stocking mostly in isolated waters, and interactions between stocked brown trout and native fish would likely depend on survivability and fish size.

### **Hybridization between stocked trout and native trout**

Hatchery-reared rainbow trout and cutthroat trout will not be stocked into Apache trout or Gila trout recovery streams, which are located above natural or artificial barriers that prevent upstream movement of fish into protected recovery areas. It is possible that hybridization between nonnative trout (*Oncorhynchus* spp) and native trout could occur based on the following scenarios: 1) recovery populations of native trouts above barriers may move out of the recovery areas downstream of barriers and potentially hybridize with nonnative trout; and 2) barrier failure may result in the ability of nonnative congeneric trout to reach recovery areas and hybridize with native trout.

Proposed stocking species: walleye

### **History of stocked walleye**

Walleye, native to the Midwestern United States and most of Canada, were introduced into Arizona in 1957.

**Survival of stocked walleye**

The survival of age-1 walleye stocked into Oneida Lake, New York, was estimated at 40% during the first 1.5 months post-stocking, and only 0.2-3.2% survived to age 4 (VanDeValk et al. 2007). Survival of stocked walleye fry for the first 24 hours post-stocking ranged between 0-34% (Pitman and Gutreuter 1993).

**Piscivory in walleye**

The diets of walleye in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al. 1984). Walleye older than 1 year were predominately piscivorous, consuming shiners, clupeids, and spiny-rayed fishes depending on seasonal availability. Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad where the species co-occur (Minckley 1973).

Proposed stocking species: yellow perch

**History of stocked yellow perch**

Yellow perch, native in central and eastern Canada and the United States, were introduced into Arizona in 1919.

**Piscivory in yellow perch**

There was insufficient information available in the literature on the survivability of yellow perch and competitive interactions with native fish. However, competition, including displacement, can occur with native fish where resources are limited and species co-occur. The diets of yellow perch in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al. 1984). Most yellow perch consumed similar amounts of invertebrates and fish (e.g., 80-100% of diets were insects from April to August). Yellow perch switched to gizzard shad and shiners in the late summer early fall, then switched back to invertebrates as the numbers of forage fish declined. Out of the highly piscivorous ecotype, fish accounted for 5-25% of diets in the spring, 5-60% of diets in the summer, and 40-60% of diets. Yellow perch exhibited ecotypes that may consume fish exclusively (16%), invertebrates exclusively (35-59%), or a combination of both (25-48%; Paradis et al 2006). Bonar et al. (2005) documented piscivory in yellow perch at approximately 7%, with invertebrates as the dominant prey type.

***Interactions Between Native Fish and Stocked Fish*****Apache trout**

Interaction species: Apache trout, Arctic grayling, brook trout, cutthroat trout, rainbow trout

**Habitat preferences and diet of Apache trout**

Information concerning specific stream habitat requirements for all life stages of Apache trout is limited, but habitat preferences are similar to those of rainbow trout and cutthroat trout.

Recovery populations of Apache trout currently exist mainly in headwater areas upstream from natural and artificial barriers. This environment is subject to extreme variations in both temperature and flow. Instream cover and bank cuts are important variables defining Apache trout habitat. In general, Apache trout select areas with the greatest depths and cover in the absence of nonnative trout. The temperature tolerances of Apache trout are similar to other species of trout, with critical limits above 25°C (Alcorn 1976, Lee and Rinne 1980).

Apache trout spawning in the White Mountains occurs from March through mid-June, and varies with stream elevation. Apache trout begin redd construction and associated spawning during receding flows in the spring, at approximately 8°C (Harper 1978). Redds are constructed primarily at downstream ends of pools in wide varieties of substrates (0.87 mm to 32 mm size), most frequently in water depths from 19-27 cm in areas that receive day-long illumination, with water velocities ranging between 50-110 cfs (Harper 1976). Spawning maturation is estimated to begin at 3 years of age, with eggs hatching in approximately 30 days, and emergence occurring about 60 days after deposition (Harper 1978).

The Apache trout is largely an opportunistic feeder that eats a variety of aquatic and terrestrial organisms, the utilization of which can vary with the season and fish size. Studies have shown Apache trout to be diurnal feeders, with mayflies and caddisflies dominating their diets in stream environments (Robinson and Tash 1979). In lake habitats, Apache trout have been observed to feed on aquatic and terrestrial insects, zooplankton, crustaceans, snails, leeches, nematods, and fish (Clarkson and Dreyer 1996). Piscivory in Apache trout *in situ* has not been documented in stream systems.

#### Interaction: competition

Apache trout, cutthroat trout, and rainbow trout.—Competition for food or habitat, where limiting, among *Oncorhynchus* spp of trout may occur if the species interact due to overlaps in diet and habitat preferences. When trout are stocked or co-stocked with recreationally stocked Apache trout multiple times in a concentrated area, competition among stocked and resident trout for food or habitat would likely occur for a few weeks, which is when most stocked trout would be caught in the creel.

Apache trout stocked for recreation in an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River. Once stocked, Apache trout will be considered part of the recovery population. All other recreational stockings of Apache trout will occur in non-recovery areas for Apache trout.

Arctic grayling.— Natural reproduction of Arctic grayling in Arizona has not been documented and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. Because diets and habitat preferences overlap between Arctic grayling and Apache trout, there may be competition for food or habitat if the species co-occur.

Brook trout.—Competition between Apache trout and nonnative brook and brown trout has been implicated in the decline of the species mainly due to intraspecific competition for habitat (USFWS 2009a) There are some diet and habitat similarities between brook trout and Apache

trout, thus, competition for food or habitat is possible if the species co-occur.

#### Interaction: hybridization

Hybridization between Apache trout and congeneric rainbow trout and cutthroat trout has been implicated in the primary cause of the decline of the species (USFWS 2009a). Hybridization between rainbow or cutthroat trout and recovery Apache trout would be possible considering the following scenarios: 1) recovery populations of native trout above barriers may move out of the recovery areas downstream of barriers and potentially hybridize with nonnative trout and 2) barrier failure may result in the ability of nonnative congeneric trout to reach recovery areas and hybridize with native trout. If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. If recreationally stocked Apache trout survive the creel, it is possible that they may hybridize with stocked or resident nonnative trout that also survived the creel or are resident populations.

#### Interaction: predation

Apache trout.—Apache trout were downlisted from endangered to threatened in 1975 with an accompanying Endangered Species Act (ESA) 4(d) rule allowing Arizona and the White Mountain Apache Tribe to regulate take of the species and to establish sport fishing opportunities. As such, Apache trout are raised in AGFD hatcheries to catchable size and stocked into streams and lakes for recreational put-and-take fisheries. Because most stocked trout will be caught by anglers within the first few weeks post-stocking, and because many stocking locations do not provide suitable habitat and stream temperatures, they are not expected to establish viable populations.

Thus, the impact of stocking recreational Apache trout is the loss of individuals from a seasonally-temporary sport fish population and does not detract from the overall recovery of Apache trout. The co-stocked rainbow trout may compete for food and foraging habitat with the stocked Apache trout. The recreational stocking of Apache trout provides a conservation benefit by increasing public acceptance and appreciation for native and endangered species, and reduction of the risk of invasion and hybridization downstream of Apache trout recovery barriers.

The majority of trout stocked on a weekly basis through the summer months are caught within the first few days following stocking. Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and resident Apache trout would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al. 2007, Jones et al. 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on

salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and Apache trout would be rare.

Brook trout.—Brook trout are more predacious than rainbow and cutthroat trouts. Piscivory has been documented to range between 3-60% (Fraser 1981, Cunjak et al. 1987, L'Abée-Lund et al. 2002, Mistak et al. 2003, Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al. 2002).

Stocked brook trout may prey upon eggs, larvae, and juvenile Apache trout if recreationally stocked Apache trout become established and if the species co-occur. Because stocked brook trout and stocked Apache trout are similarly sized, predatory interactions between the species adults are not likely.

Rainbow trout and cutthroat trout.—Hatchery-reared rainbow and cutthroat trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Recreation Apache trout that survive the creel would likely become hybridized with resident rainbow trout that occur close to Apache trout stocking locations. If recreationally stocked Apache trout become established, predation by stocked rainbow trout on the eggs, larvae, and juvenile Apache trout is possible if the species co-occur. Because stocked rainbow trout and stocked Apache trout (for recreation) are similarly sized, predatory interactions between the species adults are not likely.

#### Apache Trout Interactions- Additional analysis

### **Conservation of the Apache Trout & Description of the Special 4(d) Rule**

Reclassifying the species from endangered to threatened has had no effect on the regulations designed to protect and recover Apache trout. The only change was to allow take related to recreational fishing as provided in the special 4(d) rule, which accompanied the downlisting. In general, establishment of recreational opportunities can be developed in recovery waters that have stable or increasing numbers of individuals and where habitat conditions are of sufficient quality to support viable populations of Apache trout under managed angling. In addition, recreational opportunities may be developed in non-recovery waters. The principal effect of the special rule is to allow take in accordance with fishing regulations enacted by AGFD, which were developed using the best available science.

A special rule for a threatened species may be issued by the Fish and Wildlife Service when it is deemed necessary and advisable to provide for the 'conservation' of the species. The term conservation, as defined in section 3(3) of the Endangered Species Act, means to use and the use of all methods and procedures necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. The authority to take endangered or threatened species to relieve population pressures is applicable to

our recovery efforts for Apache trout. Apache trout stocked for the purpose of providing angling opportunity are surplus to recovery needs.

Specifically, this special 4(d) rule contributes to the conservation of the Apache trout by: (1) Providing eligibility for Federal sport fishing funds, (2) enhancing the ability to monitor populations, and (3) creating goodwill and support in the local community. Despite these benefits, it is probable that some Apache hybrids would be produced given that other trout including rainbow trout, cutthroat trout, brook trout and brown trout may be co-stocked or existing as wild reproducing populations are present in most reaches and connecting waters proposed for stocking. Apache trout might also be lost to predation or competition with other species co-stocked with Apache trout or nonnative wild species already established in the system; however, the benefits far outweigh any potential negative aspects of this action. Finally, if Apache trout were stocked in additional waters, the angling public would be exposed to, and become more familiar with, Apache trout's natural beauty and value as a sport fish, thereby increasing public support for the program. There are several lakes and stream segments in Arizona that are not currently identified in long-term recovery strategies and that could provide quality angling opportunities for Apache trout.

#### **Standard Effects Analysis: Nonnative Sport Fish Stocking**

1. Stocked Apache trout co-stocked with other species: Apache trout stocked from the hatcheries are for the specific purpose of providing fishing opportunities. Recovery streams are managed for self-sustaining Apache trout populations and regular stocking is not part of that management except with wild trout to initiate and augment the population as needed until it becomes self-sustaining. Apache trout stocked for recreational purposes are considered excess to the survival and recovery of the species. Take of these stocked fish via harvest by anglers is allowed under the section 4(d) rule contained in the designation of the Apache trout as a Threatened species. That rule allows take of Apache trout if such take is in accordance with State law; in this case through possession of a valid Arizona fishing license and trout stamp.  
Impacts to stocked Apache trout from co-stocked sport fish species may include predation, competition, and/or hybridization with stocked trout. A detailed discussion of these impacts was provided immediately preceding.
2. Apache trout escapement from recovery areas and exposure to stocked sport fish: If recovery Apache trout were to move out of designated recovery areas to areas where stocked Apache trout or other stocked species may be present, they would be considered assimilated into the existing Apache trout population and subject to the special 4(d) rule. They would no longer be distinguishable from the stocked Apache trout, and would no longer contribute towards recovery. Impacts to these individuals would be assessed in the same manner as for stocked Apache trout in non-recovery areas (see #1 above).
3. Stocked sport fishes moving above failed barriers or moving into recovery reaches: Impacts to recovery Apache trout are not expected to occur because recovery populations are located above constructed barriers, which prevent upstream movement of all fish. Should barrier failure occur, the Forest Service and AGFD would attempt to repair the barrier and if necessary renovate the reach to remove nonnative fish. During this period of time, if stocked fish move above the failed barrier, predation, hybridization with other trout and/or competition with Apache trout could occur.

There are three stocking sites that are not separated by a barrier from a recovery Apache trout reach; they are:

- Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River whereby Apache trout stocked into Lee Valley Lake, upstream of the recovery reach, could escape and move into the recovery population. Apache trout are also stocked directly into the recovery population at Sheeps Crossing (see #4 below)
- a recovery population in the South Fork of the Little Colorado River. This recovery reach is located above a barrier; however, Mexican Hay Lake is located upstream of both the barrier and recovery reach. Apache trout stocked into Mexican Hay Lake may escape and reach the recovery population downstream, and
- Ackre Lake, located in the headwaters of Fish Creek Fish Creek is a recovery stream, and Apache trout or Arctic grayling may escape Ackre lake and enter the recovery population downstream in Fish Creek.

### **Standard Effects Analysis: Apache Trout Stocking**

A detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.) between Apache trout and other listed species was provided above. Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed in the watershed analyses (Chapters 5- 11 as appropriate). Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described later in this chapter.

1. Stocked Apache trout into recovery Apache trout: The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted. Apache trout stocked for recreation into an Apache trout recovery stream will only occur at Sheep's Crossing on the Little Colorado River. All other recreational stockings of Apache trout will occur in non-recovery areas for Apache trout. This recovery population is designated open to angling under the special 4(d) rule. Once stocked, Apache trout will be considered part of the recovery population. AGFD would stock hatchery reared apache trout into the recovery population at densities expected to maintain angler satisfaction while minimizing impacts to the population as a whole. Some density dependent competition may occur in the stocking reach however not throughout the entire recovery reach since stocking only occurs at the lower end of the reach where angler access is possible.
2. Impacts from stocked Apache trout on other candidate or listed species and critical habitat: Impacts from stocked Apache trout on listed species may include predation, and/or competition for resources. AGFD's intent is to manage for a native Apache trout fishery (rather than a nonnative fishery) by maintaining an Apache trout stocking

program that provides angling opportunities to not only promote a native fish community, but also to further conservation for not only Apache trout, but additional listed aquatic species found within the areas proposed for stocking of Apache trout. This strategy is an attempt to balance native and sport fish management in the state by taking advantage of opportunities to utilize native fishes to provide both sport opportunity and conservation. While Apache trout may prey on, or compete with, other candidate or listed species, the AGFD's intent in these stocking areas is to recreate what happened in nature historically (i.e., a native predator eating a native prey species).

3. Impacts from wild populations on stocked Apache trout: The action of stocking Apache trout is considered a conservation action in furtherance of the Endangered Species Act whereby a special 4(d) rule is in place. AGFD may take any federally listed threatened fish or wildlife for conservation purposes that are consistent with the purposes of the Act and the Section 6 Cooperative Agreement between USFWS and AGFD and therefore take of Apache trout from the proposed stocking of Apache trout is legally permitted. Impacts to stocked Apache trout from species of fish currently existing as wild, self reproducing populations at or in proximity to proposed stocking locations may include predation, hybridization with other trout and/or competition.

### Site specific analyses

The six possible stocking situations that would impact Apache trout (AT) were described above. The stocking locations that may result in each of the six situations are presented in Table 15 and are:

1. Stocked AT co-stocked with other species;
2. Recovery AT escaped and into stocked fish;
3. Stocked fish moving above barriers or moving into AT recovery areas;
4. Stocked AT stocked into recovery AT;
5. Stocked AT impacting other candidate or listed species and/or critical habitat; and
6. Stocked AT into established nonnative populations.

**Table 15. Stocking situations (1-6) that apply to the proposed Apache trout stocking sites.**

*ATr = recovery Apache trout ATs = stocked Apache trout*

| Complex         | Stocking Site            | Situation | Notes                                                                                                                                                                                                                                                                                                                                 |
|-----------------|--------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LCR above Lyman | Becker Lake              | 1, 6      | Stocking RT, AP and grayling.                                                                                                                                                                                                                                                                                                         |
| West Fork LCR   | White Mountain Reservoir | 2, 3      | RT stocked, could move downstream, if barriers on south failed stocked RT could move upstream into the recovery reach.                                                                                                                                                                                                                |
|                 | Mexican Hay Lake         | 3, 6      | Only AT stocked. If there is an irrigation release, ATs could possibly reach the South Fork LCR and a population of ATr. If ATs make it downstream as far as the LCR (very unlikely they will get out of Mexican Hay Lake because since the outlet is non functional) they could come into contact with wild brown and rainbow trout. |



| Complex                    | Stocking Site           | Situation  | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|-------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | Lee Valley Lake         | 1, 3, 4, 6 | Stocking AT and grayling. ATs and grayling may move downstream into the West fork (recovery population); emigration is expected to be low and ATs would assimilate into recovery populations. ATs or grayling would not be able to reach east fork except for in the event of a valve check every 10 yrs. Stocked APs could even move further downstream into River Reservoir or LCR where wild rainbow trout and brown trout are present |
|                            | Bunch Reservoir         | 1, 3, 6    | Stocking RT and AT. For Bunch, Tunnel and River there is a possibility of either RT or ATs reaching ATr if the barriers fail on the West Fork or South Fork.                                                                                                                                                                                                                                                                              |
|                            | Tunnel Reservoir        | 1,3, 6     | Stocking RT and AT. See Bunch                                                                                                                                                                                                                                                                                                                                                                                                             |
|                            | River Reservoir         | 1,3, 6     | Stocking RT and AT. See Bunch                                                                                                                                                                                                                                                                                                                                                                                                             |
|                            | LCR Greer               | 1, 2, 3, 6 | Stocking RT and AT. If barriers at West Fork and East Fork LCR; or movement of ATr over the barriers into the LCR Greer.                                                                                                                                                                                                                                                                                                                  |
|                            | LCR at Sheep's Crossing | 2, 4, 6    | Stocking AT into a ATr reach. In this reach stocked APs = ATr, and they could move downstream into LCR Greer, River Reservoir and the LCR below that.                                                                                                                                                                                                                                                                                     |
| Upper LCR                  | Little Ortega Lake      | 2, 3       | ATr in Mineral creek upstream from Little Ortega above a barrier. CC stocked in Little Ortega.                                                                                                                                                                                                                                                                                                                                            |
| White Mountain (LCR)       | Silver Creek            | 1, 6       | Stocking RT and AT.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Schoen's Complex (LCR)     | Show Low Lake           | 1, 6       | Stocking RT, BT, CT, AT, CC and bluegill.                                                                                                                                                                                                                                                                                                                                                                                                 |
|                            | Show Low Creek          | 1, 6       | AT stocked in Show Low Lake could move downstream into Show Low Creek. Possible impacts from trout stocked in the creek and resident RT non native fishes.                                                                                                                                                                                                                                                                                |
|                            | Fool's Hollow           | 1, 6       | Stocking RT, BT, CT, AT, CC and bluegill.                                                                                                                                                                                                                                                                                                                                                                                                 |
| Black River Complex (Salt) | Ackre Lake              | 1, 3, 6    | Stocking AT and grayling. ATs could go over spillway into ATr in Fish Creek. ATs could move into Black River and up into ATs on the East Fork or ATr if barrier fails on the West Fork.                                                                                                                                                                                                                                                   |
|                            | Big Lake                | 1, 3, 6    | Stocking RT, CT, BT, and AT. If ATs reached the West Fork and the barriers failed.                                                                                                                                                                                                                                                                                                                                                        |
|                            | East Fork               | 1, 2, 3, 6 | Stocking RT and AT. . If ATs reached the West Fork and the barriers failed. Escapement of ATr into stocked ATs and RT at East Fork.                                                                                                                                                                                                                                                                                                       |
|                            | West Fork               | 2, 3, 6    | Stocking AT only. If barriers fail.                                                                                                                                                                                                                                                                                                                                                                                                       |

### **Bonytail chub**

Interaction species: bluegill, channel catfish, largemouth bass, rainbow trout, redear sunfish

### **Habitat preferences and diet of bonytail chub**

The primary threats to bonytail chub include streamflow regulation, habitat changes, impacts of nonnative fish, pesticides, and pollution (USFWS 2002a). Because wild bonytail are rare, and

reproduction is rarely documented, impacts by stocked nonnative fish are primarily to hatchery fish stocked to establish self-sustaining populations. Bonytail chub utilize mainstream portions of mid-sized to large rivers (both strong current and pools), usually over mud or rocks at elevations from 235 – 1,960 feet. During spring flooding they utilize inundated terrestrial habitats. In reservoirs, bonytail chub occupy a variety of habitat types, but seem to appear to prefer the open water areas. Certain characteristics of bonytail chub, such as smaller, reduced or embedded scales and relatively small eyes may be adaptations to the high silt loads which characterized the remarkable erosive, turbid Colorado River systems prior to the constraint of dams (Minckley 1973).

In Lake Mohave, spawning has been observed during the month of May, while in the upper Green River, spawning occurs in June and July at water temperatures of about 18° C (64°F) (Minckley 1973). Eggs are scattered over the bottom; no parental care occurs.

In rivers, bonytail chub adults eat primarily terrestrial insects, plant debris, and algae, while juveniles eat aquatic insects. In lakes they apparently feed on algae and plankton. Low levels of piscivory in bonytail chub have been documented (8% of diet; Minckley and Marsh 2009).

#### Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although there are differences in general habitat preferences between species, backwater habitats can provide habitat for either species. Bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. There may be overlap in habitat between species, particularly for juvenile catfish whose diet is predominately macroinvertebrates. Adult channel catfish also feed primarily on macroinvertebrates, but exhibit piscivory varying with fish size. Although there are differences in general habitat preferences between the species, competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Largemouth bass.—Largemouth bass are considered generalists and can live in a variety of habitats, prefer sluggish waters of lakes and reservoirs, but are able to colonize larger streams that have low gradients and velocity (Moyle 2002, Pacey and Marsh 1998). There is little to no data supporting largemouth bass occupying higher velocity stream habitats (e.g., riffles, runs, glides, eddies). Adult bonytail chub in rivers prefer fast-moving waters in mainstem portions, but can inhabit backwater areas also. Although there are differences in habitat preference between the species, overlap may occur when preferred habitat is not available.

Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are the primary food source for bonytail chub.

This could lead to competition for food or habitat, where limiting, between the species if they co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in bonytail chub habitat because of high water temperatures and turbidity. Rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

Redear sunfish.—Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Moyle 2002). In rivers and streams, they prefer deep, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks) and are not reported in riffle, run, or glides, and avoid turbidity. Although there are differences in habitat preference between the species, overlap may occur when preferred habitat is not available. Redear sunfish feed primarily on invertebrates, thus competition for food or habitat, where limiting, with bonytail chub is possible if they co-occur.

#### Interaction: predation

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on bonytail chub is possible if the species co-occur. There are currently no wild populations of bonytail chub and interactions would most likely be with stocked bonytail chub. Although reproduction in the wild has not been documented recently, if reproduction occurs, stocked bluegill may prey upon eggs, larvae, and juvenile bonytail chub if interactions occur. Because stocked bluegill and stocked bonytail chub are similarly sized, predatory interactions between the species adults are not likely.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Flathead catfish, channel catfish, and largemouth bass predation on razorback sucker has been documented (Marsh and Brooks 1989, USFWS 2002b). In the upper Colorado River basin, channel catfish were widespread and common in bonytail chub habitat, even when chub populations were common (Bestgen et al. 2008).

Although reproduction in the wild has not been documented recently, if reproduction occurs, predation by channel catfish on recently stocked bonytail chub is possible, particularly by catfish greater than 550 mm. However, macroinvertebrates are the dominant component in channel catfish diets, regardless of fish size, but particularly for juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates and are smaller than stocked bonytail chub, predation on stocked bonytail chub would be rare.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass, however, they can be highly piscivorous; thus, there may be predation by stocked largemouth bass on stocked bonytail chub if interactions exist. Although reproduction in the wild has not been documented recently, if reproduction occurs, largemouth bass may predate on bonytail chub eggs, larvae, and juveniles if the species co-occur. The differences in general habitat preferences

between these two species may reduce the opportunity for predatory interactions. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Rainbow trout stocked into bonytail chub habitat that may enter the river would not be expected to survive more than a few months due to predation by larger resident top predators, high water temperatures in the summer, and high turbidity. Because stocked rainbow trout and stocked bonytail chub are similarly sized, predatory interactions between the species adults are not likely. Although reproduction in the wild has not been documented recently, if reproduction occurs, predation by stocked rainbow trout on the eggs, larvae, and juvenile bonytail chub is possible if the species co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation on bonytail chub eggs, larvae, and juveniles is possible if they co-occur and bonytail chub reproduction occurs. Because adult redear sunfish and stocked bonytail chub are similarly sized, the potential predation on stocked bonytail chub would be rare.

### Colorado pikeminnow

Interaction species: bluegill, channel catfish, largemouth bass, rainbow trout

#### Habitat preferences and diet of Colorado pikeminnow

Colorado pikeminnow prefer rivers with high silt content, warm water, turbulence, and variable flow by season less than 1,219 m (4000 ft) in elevation. Adults inhabit pools and eddies just outside the main current, while young are found in backwater areas. During winter, Colorado pikeminnow use backwaters, runs, pools, and shallow shoreline areas. In spring and early summer, Colorado pikeminnow use shorelines and lowlands inundated during typical spring flooding (USFWS 1994). The USFWS established “nonessential” experimental population areas for the pikeminnow in Arizona on July 24, 1985 (50 FR30188-30195). Two areas were designated; the Salt River from Roosevelt Dam to the U.S. Highway 60 Bridge, and the Verde River from Horseshoe Dam to Perkinsville. No pikeminnow are likely present in the upper Verde River at this time.

Spawning Colorado pikeminnow in the Green and Yampa Rivers occurs most frequently in summer months with average water temperatures between 22- 25 °C, but Pacey and Marsh report that reproduction can occur across a wide range of temperatures (14 – 28 C°). Data from the Green River indicate that upon emergence from spawning substrates, Colorado pikeminnow fry enter the stream drift and are transported downstream for approximately 6 days, traveling an average distance of 160 km (100 mi) to reach nursery areas in low gradient reaches (Tyus and Haines 1991).

The Colorado pikeminnow is the largest American minnow, and can grow up to 1.8 m (6 ft) long and reach a weight of 36 kg (80) lbs. Juvenile Colorado pikeminnow feed primarily on

zooplankton and insect larvae (Tyus 1991, USFWS 1990a). Adult Colorado pikeminnow are primarily piscivorous, the only highly predatory native fish species in Arizona. The juvenile and adult life-stages of the species and other members of the genus are documented to eat small mammals and birds in addition to a variety of fishes (USFWS 1990a, Pacey and Marsh 1998). The last wild adult Colorado pikeminnow record in Arizona was collected from Lake Mohave on the Colorado River in 1967 (Minckley and Deacon 1968). Natural populations are restricted to the upper basin states in the Green, Yampa, White, and Colorado Rivers (USFWS 1990a and citations therein). Since 1995, the AGFD and cooperators have stocked 14,816 Colorado pikeminnow into the Verde River at 2 locations near Camp Verde and Childs (D. Weedman pers. comm.). The minimum size of pikeminnow stocked is 300 mm.

#### Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although there are differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with juvenile Colorado pikeminnow is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. There may be overlap in habitat between species, particularly between juvenile catfish and pikeminnow whose diets include zooplankton and insects. Adult channel catfish are more piscivorous and adult pikeminnow are predominately piscivorous, thus competition for food or habitat, where limiting, is possible if they co-occur.

Largemouth bass.—Largemouth bass are considered generalists and can live in a variety of habitats, prefer sluggish waters of lakes and reservoirs, but are able to colonize larger streams that have low gradients and velocity (Moyle 2002, Pacey and Marsh 1998). There is little to no data supporting largemouth bass occupying higher velocity stream habitats (e.g., riffles, runs, glides, eddies). Largemouth bass may be highly piscivorous, particularly at larger sizes. Due to similarities in diet and habitat preferences between largemouth bass and pikeminnow, competition for food or habitat, where limiting, is possible if they co-occur. This could lead to competition for food or habitat, where limiting, between the species if they co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in pikeminnow habitat because of high summer water temperatures and turbidity. Although there are differences in general habitat preferences between the species, rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, with Colorado pikeminnow juveniles is possible if they co-occur.

#### Interaction: predation

Bluegill.—Although there are differences in general habitat preferences between species, and

dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on Colorado pikeminnow is possible if the species co-occur. If predation occurs, it would be limited to the eggs, larvae, and juvenile Colorado pikeminnow because adult pikeminnow are substantially larger than adult bluegill.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on Colorado pikeminnow larvae and juveniles would be rare. Larger channel catfish can be more piscivorous, but because adult pikeminnow may be significantly larger than adult catfish, predation on pikeminnow by adult catfish may be limited to eggs, larvae, and juvenile pikeminnow if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, there may be predation by stocked largemouth bass on larval and juvenile Colorado pikeminnow if interactions occur. Due to the large sizes of adult largemouth bass and pikeminnow, predatory interactions between species adults are unlikely.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Rainbow trout stocked into pikeminnow habitat would not be expected to survive more than a few months due to predation by larger resident top predators, high water temperatures in the summer, and high turbidity. Because adult pikeminnow are significantly larger than stocked rainbow trout, predation on pikeminnow by rainbow trout may be limited to eggs, larvae, and juvenile pikeminnow if the species co-occur.

### Desert pupfish

Interaction species: bluegill

#### Habitat preferences and diet of desert pupfish

Desert pupfish are found in shallow water of desert springs, small streams, and marshes below 1,515 m (5,000 ft) elevation. Most habitats include clear water and soft substrates. The species can tolerate high salinities (concentrations twice that of seawater, 68g/l), high water temperatures (to 45°C), and low dissolved oxygen (0.1-0.4 mg/l) (USFWS 1993).

Larval desert pupfish feed on invertebrates and as they grow become omnivorous. Adults feed on ostracods, copepods, and other crustaceans and insects, pile worms, molluscs, aquatic macrophytes, detritus, and algae.

#### Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although

there are differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with desert pupfish is possible if the species co-occur.

#### Interaction: predation

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on desert pupfish is possible if the species co-occur.

#### Gila chub

Interaction species: bluegill, brook trout, brown trout, channel catfish, cutthroat trout, largemouth bass, rainbow trout, redear sunfish, threadfin shad, white crappie.

#### Habitat preferences and diet of Gila chub

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in artificial impoundments. Generally, Gila chub are associated with cover including: terrestrial vegetation, boulders, fallen logs (Rinne and Minckley 1991) and undercut banks created by over hanging terrestrial vegetation (Nelson 1993). Habitat selection is life stage specific with adults commonly found in deep pools and eddies below areas with swift currents (Minckley 1973). Young-of-the-year inhabit shallow water among plants or eddies, and older juveniles use higher-velocity stream areas such as riffles (Minckley 1973). Dudley (1995) observed temporal variation in habitat selection in Sabino Canyon whereby Gila chub occupied dark interstitial spaces during winter and sub-adults were observed farther from cover and frequently in shallow areas or higher current areas during summer as water temperatures warmed.

Gila chub probably mature in their second to third year. Reproduction occurs primarily from late spring into summer in streams, but can extend into late winter in constant temperature springs. Generally breeding is initiated with warmer water temperatures of 20 – 26.5 °C (68 – 79.7 °F). Gila chub prefers to spawn over submerged aquatic vegetation or root wads.

Griffith and Tiersch (1989) describe Gila chub as omnivorous. Rinne and Minckley (1991) identify that Gila chub feed on large and small aquatic and terrestrial invertebrates, and small fishes. Smaller individuals feed on organic debris, aquatic plants (especially filamentous algae), and diatoms (unicellular or colonial algae). Griffith and Tiersch (1989) found that Gila chub in Redfield Canyon consumed speckled dace, dobsonfly nymphs (order Megaloptera), terrestrial insects (e.g., ants, caterpillars, and beetles). A high presence of algae (diatoms) and small gravel (indicating bottom feeding) were also found to be present in their diet.

#### Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Aquatic

insects are a major food source for both bluegill and Gila chub. Although there are minor differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with Gila chub is possible if they co-occur.

Brook trout and brown trout.—Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Macroinvertebrates are a major food source for channel catfish, especially for juveniles. Since macroinvertebrates are a major food source for Gila chub, competition for food or habitat, where limiting, is possible if the two species co-occur.

Cutthroat trout and rainbow trout.—Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are a major food source for Gila chub. This could lead to competition for food or habitat, where limiting, between the species if they co-occur. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Since redear sunfish diets contain aquatic insects, competition for food or habitat, where limiting, is possible if the species co-occur. However, redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Moyle 2002). Pacey and Marsh (1998) also include rivers and streams as potential habitat, with microhabitat preferences of deeper, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks). The differences in general habitat preferences between these two species may reduce the opportunity for predatory interactions. However, habitat use may overlap when preferred habitat is not available.

Threadfin shad.—In Arizona, threadfin shad are a small prey fish found primarily in reservoirs. Differences in habitat preferences between the two species may reduce the opportunity for competition. Because of some similarities in diet, competition for food or habitat, where limiting, is possible if they co-occur.

White crappie.—The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since white crappie diets contain aquatic insects, competition with Gila chub for food or habitat, where limiting, is possible if they co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for competition.



Interaction: predation

Bluegill—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on Gila chub is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile Gila chub due to size similarities between adult bluegill and adult Gila chub.

Brook trout.—Brook trout are more predacious than rainbow trout and cutthroat trout and piscivory has been documented to range between 3-60% and was documented at 25% in Arizona. Because adult brook trout and Gila chub are similarly sized, predation on adult Gila chub is not likely. Predation could occur, however, on eggs, larvae, and juvenile Gila chub if the species co-occur.

Brown trout.—A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Their piscivorous behavior, as well as its plasticity, is well documented and can vary significantly. Piscivory rates for brown trout in Arizona have been documented at 33% (Sweetser et al. 2002). Because adult brown trout and adult Gila chub are similarly sized, predation on adult Gila chub is not likely. Predation could occur, however, on eggs, larvae, and juvenile Gila chub if the species co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on Gila chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on Gila chub is possible if the species co-occur.

Cutthroat trout and rainbow trout.—Wild rainbow and cutthroat trout, not including steelhead or coastal populations of either species, are opportunistic feeders that primarily consume aquatic and terrestrial insects (see references in Background). Hatchery-reared rainbow are opportunistic feeders that primarily consume macroinvertebrates once stocked, and rarely consume fish (piscivory rates 0-9%). Piscivory in stocked hatchery-raised cutthroat trout has not been well documented. However, for wild native cutthroat trout species piscivory has ranged between 0-2.9% in stream systems (Fleener 1952, Young et al. 1997, McGrath and Lewis 2007) and was documented at 22% for trout larger than 400 mm in Lake Washington (Nowak et al. 2004). Because adult trout and adult chub are similarly sized, predation on adult Gila chub is not likely. Although stocked rainbow trout and cutthroat trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile Gila chub if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on Gila chub is possible if they co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur.

Threadfin shad.—Threadfin shad feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971). In Lake Chicot, Arkansas the primary constituents of the threadfin shad diet were algae (54%) and animal material (49.5%) with most of algae diet containing green algae (Chlorophyta) and most of the animal material consisting of protozoans and invertebrate eggs (Miller 1967). Because predation by threadfin shad on fish larvae has only been documented in lacustrine habitats, negative predatory interactions between threadfin shad and stream-dwelling Gila chub would be rare.

White crappie.—The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since the diet of adult white crappie may contain fish, piscivory on Gila chub is possible if the species co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for predatory interactions. They are not known to persist in Arizona's streams.

### Gila topminnow

Interaction species: black crappie, bluegill, channel catfish, cutthroat trout, largemouth bass, rainbow trout, redear sunfish, threadfin shad, white crappie

### Habitat preferences and diet of Gila topminnow

Gila topminnow generally prefer shallow, warm, and fairly quiet waters; however, populations can become acclimated to a much wider range of environmental conditions. For example, environmental variability includes temperature tolerances that range from near freezing to 37°C, pH ranges of 6.6 - 8.9, dissolved oxygen concentrations ranging from 2.2 - 11 mg/l, and salinities equal to seawater. Gila topminnow prefer habitats that contain dense algal mats and debris, usually along stream margins or below riffles, and sandy substrates sometimes covered with organic mud and debris. Gila topminnow is usually found in the upper third of the water column and frequents the warmest and shallowest areas.

Gila topminnow are viviparous fish (i.e., embryos grow and mature within the female and are born live). Breeding occurs primarily during January-August, but in thermally constant environments may occur throughout the year (Weedman 1999). The mean interval between broods is 21.5 days, and brood size can range from 1 - 31 individuals per brood. Under optimum conditions, Gila topminnow can produce 10 broods a year at intervals of 7 - 14 days. Gila topminnow are opportunistic omnivores, feeding on detritus, vegetation, amphipods, ostracods, and insect larvae. Gila topminnow rarely consumes fishes, but can feed on larvae (Weedman 1999).

### Interaction: competition

Black crappie.—Both black crappie and Gila topminnow feed on macroinvertebrates which could lead to competition for food or habitat, where limiting, if they co-occur. The opportunities for competition are reduced because the occurrence of black crappie in streams is rare and many

populations of Gila topminnow occupy isolated springs and ponds where overlap with black crappie would not occur.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although there are minor differences in general habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with topminnow is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, because macroinvertebrates are a major food source for topminnow and catfish, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are a major food source for topminnow. This could lead to competition for food or habitat, where limiting, between the species if they co-occur. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in topminnow habitat because of high summer water temperatures. Although there are differences in general habitat preferences between the species, rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Redear sunfish.—Because redear sunfish diets contain aquatic insects, competition with Gila topminnow for food or habitat, where limiting, is possible if they co-occur. Differences in general habitat preferences between the two species may reduce the opportunity for competition.

Threadfin shad.—In Arizona, threadfin shad are a small prey fish found primarily in reservoirs. Differences in habitat preferences between the two species may reduce the opportunity for competition. Because of some similarities in diet, competition for food or habitat, where limiting, is possible if they co-occur.

White crappie.—The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since white crappie diets contain aquatic insects, competition with Gila topminnow for food or habitat, where limiting, is possible if they co-occur. White crappie primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for competition.

Interaction: predation

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%. Thus, predation by black crappie on Gila topminnow is possible if they co-occur.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on topminnow is possible if the species co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on topminnow eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on topminnow is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on Gila topminnow is possible if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preference. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Rainbow trout stocked into topminnow habitat would not be expected to survive more than a few months due to high water temperatures in the summer. Although rainbow trout feed predominately on macroinvertebrates, predation on Gila topminnow is possible if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preference. However, habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur.

Threadfin shad.—Threadfin shad feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971). In Lake Chicot, Arkansas the primary constituents of the threadfin shad diet were algae (54%) and animal material (49.5%) with most of algae diet containing green algae (Chlorophyta) and most of the animal material consisting of protozoans and invertebrate eggs (Miller 1967). Because predation by threadfin shad on fish larvae has only been documented in lacustrine habitats, negative predatory interactions between threadfin shad and topminnow would be rare.

White crappie.—The diet of juvenile white crappie consists mainly of zooplankton. Adults feed on zooplankton, invertebrates and fish (Sublette et al. 1990). Since the diet of adult white crappie may contain fish, piscivory on Gila topminnow is possible if they co-occur. White crappie

primarily occupy reservoirs (Moyle 2002), thus reducing the opportunity for predatory interactions.

### **Headwater chub**

Interaction species: channel catfish, rainbow trout

#### **Habitat preferences and diet of headwater chub**

Adult headwater chub occupy cool to warm water in mid- to headwater stretches, up to 6500 ft elevation, of mid-sized streams in the Gila River basin. They are associated with deep, near-shore pools adjacent to swift riffles and runs, and near obstructions. Preferred cover consists of root wads, boulders, undercut banks, submerged organic debris, or deep water. Substrates they associate with are gravel, small boulders, and large instream objects and preferred water temperatures range between 20-27°C with minimum temperature around 7°C. Juveniles are associated with shallow, low velocity habitat with overhead cover. In Fossil Creek, they seem to select depths between 0.9-1.5 m and velocities of 0.15 mps and are found over sandy substrates. Headwater chub first reproduce at approximately 2 to 5 years of age. As in roundtail chub, both males and females exhibit spawning coloration and tubercles, though the male's display is usually more extensive than females. Spawning generally occurs at similar water temperatures as roundtail chub and has been observed by Bestgen (1985b) at the East Fork of the Gila River when afternoon water temperatures reached 22°C. Minckley (1981) described spawning by headwater and roundtail chub as similar to other cyprinids in that several males escort each spawning female and release sperm as the female releases ova.

Headwater chub life span is 8-10 years. They grow rapidly but growth is dependent on water temperature. Headwater chub first reproduce between 2-5 years of age. Females are about 100-180 mm total length. Both males and females produce spawning tubercles. In males, tubercles are usually uniformly distributed from the head to the base of the dorsal fin and rarely to the base of the tale. Females display tubercles only on the head, operculum, pectoral and caudal fins. Both males and females may develop red/orange coloration on the opercles, posterior parts of the lips and fin bases. Spawning occurs in spring and early summer at the end of spring runoff. Suitable water temperatures range 14-24°C. Each female is escorted by several males and spawning is performed in pool, run and riffle habitat. Eggs are scattered randomly over substrate. Eggs hatch in 4-7 days at a water temperature of 19-20°C. Larval stage lasts up to 53 days.

Stomach analysis of fish from Fossil Creek in 1976 showed headwater chubs fed on aquatic and terrestrial insects, ostracods, and some plant material. Adults show seasonal variation in their diets, with the greatest diversity in spring and summer. Various aquatic invertebrates, macrophytes, and algae were present in diets in the spring with terrestrial insects and diatoms added in the summer. No piscivory was documented in headwater chubs from Fossil Creek, but there was evidence of a low level of predation on iguanid lizards. Juvenile chubs (<50mm) consisted almost exclusively of filamentous algae and diatoms. Young chubs fed on small insects, crustaceans, and algae in quiet backwaters until they reached 25 to 50 mm (0.99 to 1.97 in.) in length.

Interaction: competition

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Macroinvertebrates are a major food source for channel catfish, especially for juveniles. Since macroinvertebrates are a major food source for headwater chub, competition for food or habitat, where limiting, is possible if the two species co-occur.

Rainbow trout.—Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Interaction: predation

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on headwater chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on headwater chub is possible if the species co-occur.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Because adult trout and adult chub are similarly sized, predation on adult headwater chub is not likely. Although stocked rainbow trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile headwater chub if they co-occur.

**Humpback chub**

Interaction species: bluegill, channel catfish, rainbow trout, redear sunfish, walleye, yellow perch

Habitat preferences and diet of humpback chub

The humpback chub is found in a variety of habitats, but because of its rarity, habitat preferences are poorly understood (USFWS 1990b). The humpback prefers deep, fast-moving, turbid waters often associated with large boulders and steep cliffs. Chub can also be found in the quiet inlet water of river confluences.

In general, the species persists only in turbulent, high gradient, canyon-bound reaches of large rivers in the Colorado River Basin. Larvae prefer shallow, low-velocity nearshore pools in the Little Colorado River, and progressively move to deeper, faster areas with increasing size and age (AGFD data, Valdez and Ryel 2005). In the Colorado River in Grand Canyon, young-of-year are found in backwater and other nearshore, slow-velocity sites (Maddux et al. 1987), with similar ontogenetic tendencies (Valdez and Ryel 2005). Adults in the Colorado River in Grand Canyon and in the Upper Basin are associated with large eddy complexes (Valdez and

Hugentobler 1993, Valdez and Ryel 2005). Humpback chub appear to be more active at night (Kaeding and Zimmermann 1983).

Humpback chub reach sexual maturity at total lengths of 5 - 11.8 inches total length. Spawning probably takes place in June and July in the Grand Canyon and lower Colorado River; however, others recorded ripe fish as early as April in the main stem Colorado River (USFWS 1990b and citations therein). Both field observations and laboratory tests indicate that humpback chub reproduce at water temperatures of approximately 68°F.

Humpback chub is thought to be a bottom feeder, due mainly to its sub-terminal mouth, but also has been observed foraging throughout the water column taking epipelagic and epilithic diatoms, as well as small invertebrates, and Chironomidae larvae and adults. Humpback chubs feed predominately on small aquatic insects, diatoms and filamentous algae *Cladophora glomerata*

#### Interaction: competition

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with humpback chub is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover.

Macroinvertebrates are a major food source for channel catfish, especially for juveniles, and larger catfish may exhibit piscivory. Since macroinvertebrates are a major food source for humpback chub, competition for food or habitat, where limiting, is possible if the two species co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams. Rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Redear sunfish.—Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Moyle 2002). In rivers and streams, they prefer deep, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks) and are not reported in riffle, run, or glides, and avoid turbidity. Redear sunfish feed primarily on invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur. Differences in general habitat preferences between the two species may reduce the opportunity for competition.

Walleye.—In Arizona, walleye inhabit several lakes and are generally bottom oriented fish due to their sensitivity to light. Competition between walleye and humpback chub for habitat is unlikely since they occupy different habitat types in Arizona (lacustrine vs. fluvial). Competition

between walleye and humpback chub for food is not likely because of significant differences in diets.

Yellow perch.—Yellow perch prefer the shoreline areas of clear lakes and ponds with moderate amounts of aquatic vegetation (Sublette et al. 1990). They may also be found in pools and backwaters of rivers. Preferred water temperatures are between 18-21°C. Fingerlings are found in shallow water and move to open, deeper water in fall. Adults generally associate with the lake bottom. Because yellow perch and humpback chub share some similar dietary preferences, competition for food or habitat, where limiting, is possible if they co-occur. Differences in general habitat preferences between the two species may reduce the opportunity for competition.

#### Interaction: predation

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on humpback chub is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile chub due to size similarities between adult bluegill and adult humpback chub.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on humpback chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on humpback chub is possible if the species co-occur. Predation would likely be limited to eggs, larvae, and juvenile chub due to size similarities between adult catfish and chub..

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Because adult trout and adult chub are similarly sized, predation on adult humpback chub is not likely. Although stocked rainbow trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile humpback chub if they co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur and would likely be limited to eggs, larvae, and juvenile chub due to size similarities between adult sunfish and chub.

Walleye.—The diets of walleye in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al. 1984). Walleye older than 1 year were predominately piscivorous, consuming shiners, clupeids, and spiny-rayed fishes depending on seasonal availability. Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad where the species co-occur (Minckley 1973). Thus, predation by walleye on humpback chub is possible if they co-occur.

Yellow perch.—In Arizona, the yellow perch diet may be dominated by invertebrates, with a



small level of piscivory exhibited. Elsewhere, different ecotypes of yellow perch were observed that may consume fish exclusively (16%), invertebrates exclusively (35-59%), or a combination of both (25-48%; Paradis et al 2006). Bonar et al. (2005) documented piscivory in yellow perch at approximately 7%, with invertebrates as the dominant prey type. Thus, predation by yellow perch on humpback chub is possible if they co-occur.

### Little Colorado spinedace

Interaction species: Apache trout, Arctic grayling, bluegill, brook trout, channel catfish, largemouth bass, rainbow trout

### Habitat preferences and diet of Little Colorado spinedace

Little Colorado spinedace have a wide tolerance for physio-chemical factors and occupy a variety of habitats. Stream flow preferences vary from stagnant pools to slight or swift flow, preferred substrates vary from silt to boulders, and water depth ranges from <0.5 m to 2 m. Little Colorado spinedace will occupy mid-water areas of the stream, as well as undercut banks, eddies behind boulders, and pools. They typically avoid the deepest and heavily shaded pools and relatively shallow areas (USFWS 1998a and citations therein). The Primary Constituent Elements of Critical Habitat for Little Colorado spinedace are clean permanent flowing water with pools and a fine gravel or silt-mud substrate.

Eggs are presumably randomly deposited over the stream bottom, on aquatic vegetation, or other debris (Minckley 1973). Minckley (1973) and Minckley and Carufel (1967) suggest that spinedace spawn from early summer to early autumn, and may spawn more than once a year. Minckley and Carufel (1967) reported gravid females with 650-1,000 eggs per female.

Little Colorado spinedace is predaceous, feeding primarily on aquatic invertebrates with preferences changing seasonally. In spring, Little Colorado spinedace takes primarily chironomid larvae and ephemopteran nymphs. Summer preferences include cladocerans, Heteroptera, Coleoptera, filamentous green algae, detritus, and terrestrial invertebrates (Formicidae, Diptera, Thysanoptera, and Crustacea). Fall preferences include terrestrial insects, chironomid larvae, corixidae, and elmididae. Winter feeding habits include chironomid larvae, plecopteran nymphs, and corixidae (USFWS 1998a, Blinn and Runck 1990). Blinn and Runck (1990) found that smaller fish diets are comprised of a higher percentage of small aquatic insects, ephemopterans, and chironomids.

### Interaction: competition

Apache trout.—If stocked trout leave the stocking area and travel to occupied spinedace habitat, because these trout feed primarily on macroinvertebrates, similar to spinedace, competition for food or habitat, where limiting, is possible if they co-occur. Stocked trout should be considered transient in some of the warmer habitats where spinedace occur, since they would not be expected to survive in high summer water temperatures.

Arctic grayling.—Natural reproduction of Arctic grayling stocked in Arizona has not been

documented and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. Exposure to spinedace would only occur in rare events when stocked lakes spill and grayling move into occupied spinedace habitat. Because diets and habitat preferences may overlap between Arctic grayling and spinedace, competition for food or habitat, where limiting, is possible if they co-occur. The lower temperature tolerances of grayling may reduce the opportunities for competition.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with Little Colorado spinedace is possible if they co-occur.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, because macroinvertebrates are a major food source for spinedace and catfish, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes. Aquatic insects are a component of the diet of largemouth bass and are a major food source for spinedace. This could lead to competition for food or habitat, where limiting, between the species if they co-occur. The differences in general habitat preferences between these two species may reduce the opportunity for competitive interactions. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in some occupied spinedace habitats because of high summer water temperatures. However, since hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates and macroinvertebrates are a major source of food for spinedace, competition for food and habitat, where limiting, is possible if they co-occur.

#### Interaction: predation

Apache trout.—Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and spinedace would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al. 2007, Jones et al 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term

persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and spinedace would be rare.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on Little Colorado spinedace is possible if the species co-occur.

Brook trout.—Brook trout are more predacious than rainbow trout and cutthroat trout. Piscivory has been documented to range between 3-60% (Fraser 1981, Cunjak et al 1987, L'Abée-Lund et al. 2002, Mistak et al. 2003, Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al. 2002). Thus, predation by brook trout on Little Colorado spinedace is possible if they co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on spinedace eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on spinedace is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on Little Colorado spinedace is possible if they co-occur.. The occurrence of interactions may be reduced due to differences in habitat preferences. However habitat use may overlap when preferred habitat is not available.

Rainbow trout.— The literature documents a range of piscivory in stocked rainbow trout (0-9%), thus rainbow trout may predate on spinedace if they co-occur.

### Loach minnow

Interaction species: Apache trout, Arctic grayling, brook trout, cutthroat trout, rainbow trout

#### Habitat preferences and diet of loach minnow

Loach minnow are habitat specialists occupying shallow (<20 cm), turbulent, high current velocity (30-59 cm/sec) riffle habitat (Abarca 1989, Propst and Bestgen 1991, Rinne 1992). The loach minnow is primarily a bottom-dweller that moves in the water column only briefly when moving between rocks (USFWS 1991). Loach minnow spend much of the day under protective cover (Marsh et al. 2003). The primary cause for listing the species as threatened was habitat destruction and alteration due to damming, diversions, groundwater pumping, and introduction and spread of exotic predatory and competitive fish species, especially red shiner and catfishes (USFWS 1991). Ictalurid catfishes are the only nonnative species likely to interact strongly with loach minnow due to the piscivorous feeding behavior of these catfishes and the spatial overlap in riffle habitat (USFWS 1991). Some evidence also indicates that competition with red shiner has contributed to the decline of loach minnow (Minckley and Carufel 1967, Minckley and

Deacon 1968).

Little information exists concerning the breeding biology of loach minnow. In the wild, eggs are typically deposited underneath and on the downstream side of cobbles and boulders that are partially embedded (Britt 1982, Propst et al. 1988, Vives and Minckley 1990). Spawning usually occurs in riffles that have approximately three percent gradient and suitable cobbles and boulders are typically found on the upstream edge and the sides in a horseshoe-shaped pattern around the riffle (D.L. Propst, Pers. Comm). Loach minnow were observed to spawn during February through May in Aravaipa Creek (Vives and Minckley 1990) in the same riffles occupied by non-breeding adults at other times of the year (USFWS 1991). Water temperatures recorded at sites of known egg deposition range from 16 to 20°C (Propst and Bestgen 1991) to as high as 23 °C (Vives and Minckley 1990). The loach minnow was observed to breed in the laboratory at water temperatures as low as 12.2°C.

Loach minnow forage for invertebrates in and on the substrate in shallow, turbulent riffles and do not rely on drift to feed (Abarca 1989, USFWS 1991). The loach minnow is an opportunistic benthic insectivore, feeding on larval ephemeropterans (mayfly nymphs), simuliid, and chironomid dipterans (midges). Aquatic insect groups vary in importance seasonally or among life stages. Chironomids are important to larval and juvenile loach minnow (USFWS 2000).

#### Interaction: competition

Apache trout, cutthroat trout, and rainbow trout.—Stocked Apache trout, cutthroat trout, and rainbow trout may occupy the same stream reaches as loach minnow. However, due to highly specialized habitat use of loach minnow, the opportunities for competition for food or habitat between these trout species and loach minnow would be rare. If habitat use overlaps when preferred habitat is not available, competition is possible if the species co-occur.

Arctic grayling.—Natural reproduction of Arctic grayling has not been documented in Arizona and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. Due to highly specialized habitat use of loach minnow, it is not likely that competition will occur between Arctic grayling and loach minnow. If habitat use overlaps when preferred habitat is not available, competition is possible if the species co-occur.

Brook trout.—Due to highly specialized habitat use of loach minnow, it is not likely that competition will occur between brook trout and loach minnow. If habitat use overlaps when preferred habitat is not available, competition is possible if the species co-occur.

#### Interaction: predation

Apache trout.— Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory on loach minnow has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and loach minnow would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages

feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al. 2007, Jones et al. 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and loach minnow would be rare. The highly specialized habitat use of loach minnow may reduce opportunities for predation.

Brook trout.—Brook trout are more predacious than rainbow trout and cutthroat trout. Piscivory has been documented to range between 3-60% (Fraser 1981, Cunjak et al. 1987, L'Abée-Lund et al. 2002, Mistak et al. 2003, Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al. 2002). Thus, predation by brook trout on loach minnow is possible if they co-occur. The highly specialized habitat use of loach minnow may reduce opportunities for predation.

Cutthroat trout and rainbow trout.—Wild rainbow and cutthroat trout, not including steelhead or coastal populations of either species, are opportunistic feeders that primarily consume aquatic and terrestrial insects (see references in Background). Hatchery-reared rainbow are opportunistic feeders that primarily consume macroinvertebrates once stocked, and rarely consume fish (piscivory rates 0-9%). Piscivory in stocked hatchery-raised cutthroat trout has not been well documented. However, for wild native cutthroat trout species piscivory has ranged between 0-2.9% in stream systems (Fleener 1952, Young et al. 1997, McGrath and Lewis 2007) and was documented at 22% for trout larger than 400 mm in Lake Washington (Nowak et al. 2004). Although stocked rainbow trout and cutthroat trout feed primarily on macroinvertebrates, predation could occur on loach minnow if they co-occur. The highly specialized habitat use of loach minnow may reduce opportunities for predation.

### Razorback sucker

Interaction species: black crappie, bluegill, brook trout, brown trout, channel catfish, largemouth bass, rainbow trout, redear sunfish

#### Habitat preferences and diet of razorback sucker

Razorback sucker habitat preferences change seasonally depending on water type and life stage (USFWS 1998b, 2002b). In riverine systems, adult razorback suckers prefer deep runs, eddies, flooded off-channel environments, and backwaters during spring. During summer, razorback suckers can be found in shallow water associated with submerged sandbars, and in runs and pools. During winter, slower, deeper water is preferred including runs, slack-water, eddies, and pools. In impoundments, razorback suckers use both backwater and the main impoundment. Juvenile razorback suckers in reservoirs use near-shore habitats but disperse within a few weeks. Little information is available on juvenile habitat selection within rivers; however young razorback suckers presumably require quiet, warm, shallow water as nursery habitats in rivers and backwaters can provide quiet water where there is the potential for increased food

availability. In reservoirs, coves provide warm, shallow shorelines suitable as nursery habitat.

Spawning is documented to occur in mainstem rivers, riverine-influenced areas of large impoundments, and wave-washed shorelines of reservoirs. In lacustrine habitats (Lake Mohave), spawning occurs early in the year (January-April/May). Water temperatures during spawning can range from 11.5-18°C (52.7-64.4°F). Fish congregate and spawn over flat or gently sloping shoreline areas with gravel, cobble, or mixed substrates (Douglas 1952, Bozek et al. 1990, Minckley et al. 1991) and razorback suckers are observed to spawn in water up to 5m deep. In riverine habitats, staging occurs in flooded lowlands and in eddies formed in the mouths of tributary streams. Fish then move to main-channel sand, gravel, and cobble bars for egg deposition (Tyus 1987, Tyus and Karp 1990).

The razorback sucker diet varies depending on life stage, habitat, and food availability. When larvae hatch, the mouth is terminal, which appears to facilitate great diversity in feeding behavior. In Lake Mohave, larvae feed primarily on phytoplankton and small zooplankton. As the razorback sucker grows the mouth becomes inferior and more benthic invertebrates are consumed. Juvenile feeding habits are not clearly identified. Diet contents from adult razorback suckers in riverine habitats consisted of immature Ephemeroptera, Trichoptera, Chironomidae, along with algae, detritus, and inorganic material. The diets of reservoir fish are dominated by planktonic crustaceans, but also contain some algae and detritus.

#### Interaction: competition

Black crappie.—Both black crappie and razorback suckers feed on macroinvertebrates which could lead to competition for food or habitat, where limiting, if they co-occur. Differences in habitat preferences between the species may reduce opportunities for competition.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with razorback sucker is possible if they co-occur.

Brown trout.—Brown trout can be piscivorous, but also consume macroinvertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preference and temperature tolerances between the species may reduce opportunities for competition.

Channel catfish.—Channel catfish are highly versatile, typically inhabiting medium to large warm rivers, reservoirs, lakes, stock ponds, and some larger cool water streams. Juveniles may occupy riffles and runs and adults prefer slower, deep waters with adequate cover. Because macroinvertebrates are a major food source for razorback suckers and catfish, competition for food or habitat, where limiting, is possible if the species co-occur.

Largemouth bass.—Largemouth bass may be highly piscivorous, particularly at larger sizes.

Aquatic insects are a component of the diet of largemouth bass and can be a major food source for razorback suckers. This could lead to competition for food or habitat, where limiting, between the species if they co-occur.

Redear sunfish.—Redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Moyle 2002). In rivers and streams, they prefer deep, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks) and are not reported in riffle, run, or glides, and avoid turbidity. Redear sunfish feed primarily on invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Rainbow trout.—Rainbow trout inhabit cool clear lakes and cold-water streams, and stocked rainbow trout are not likely to survive in razorback sucker habitat because of high temperatures and turbidity. Rainbow trout diets consist primarily of invertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preference and temperature tolerances between the species may reduce opportunities for competitive interactions.

#### Interaction: predation

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%). Given the feeding preferences of black crappie, predation on razorback sucker eggs, larvae, or juveniles is possible if they co-occur. Predation would likely be limited to these life stages of razorback sucker because of size similarities between adult crappie and suckers. Difference in habitat preferences between the species may reduce opportunities for predation.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on razorback sucker is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile suckers due to size similarities between adult bluegill and adult razorback suckers.

Brown trout.—A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Their piscivorous behavior, as well as its plasticity, is well documented and can vary significantly. Piscivory rates for brown trout in Arizona have been documented at 33% (Sweetser et al. 2002). Thus, predation on eggs, larvae, and juvenile razorback sucker is possible if they co-occur. Predation would likely be limited to these life stages of razorback sucker because of size similarities between adult trout and suckers. Differences in habitat preference and temperature tolerances between the species may reduce opportunities for competition.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on razorback sucker eggs, larvae, and juveniles would be rare. Larger channel catfish

can be more piscivorous, thus, predation on razorback sucker is possible if the species co-occur. Predation would likely be limited to eggs, larvae, and juvenile suckers due to size similarities between adult catfish and razorback suckers.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass, however, they can be highly piscivorous; thus, there predation by stocked largemouth bass on razorback sucker, primarily eggs, larvae, and juveniles, is possible if they co-occur. Due to the large sizes of adult largemouth bass and razorback sucker, predatory interactions between species adults are unlikely.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Because adult trout and razorback suckers are similarly sized, predation on adult suckers is not likely. Although stocked rainbow trout feed primarily on macroinvertebrates, predation could occur on eggs, larvae, and juvenile razorback suckers if they co-occur.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur and would likely be limited to eggs, larvae, and juvenile suckers due to size similarities between adult sunfish and suckers.

### **Roundtail chub**

Interaction species: Apache trout, Arctic grayling, black crappie, bluegill, brook trout, brown trout, channel catfish, cutthroat trout, largemouth bass, rainbow trout, redear sunfish, smallmouth bass, threadfin shad, walleye

#### **Habitat preferences and diet of roundtail chub**

Roundtail chub prefers to occupy cool to warm water, mid-elevation streams and rivers where typical adult microhabitat consists of pools up to 2.0 m deep adjacent to swift riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water. Smaller chubs generally occupy shallow, low velocity water adjacent to overhead bank cover. Other preferred forms of cover, especially in streams lacking deep pools, are instream boulders, undercut banks, overhanging vegetation, and root wads (Rinne and Minckley 1991). According to Minckley and DeMarais (2000), roundtail chub are less prone to using instream cover than other species of *Gila*. Adults feed in swift water and move back to pools or other forms of cover when disturbed (Vanick and Kramer 1969, Minckley 1973). Juveniles occupy backwater habitats and tend to reside primarily in shallow, swifter habitats, as they grow older (Minckley 1973, 1991; Propst 1999, Brouder et al. 2000, Bryan et al. 2000).

Roundtail chub breeds in spring and early summer as spring runoff is subsiding, frequently in association with submerged cover such as fallen trees and brush. Fertilized eggs are broadcast over gravel substrate with no parental care.



Roundtail chub follow a seasonal spawning cycle, with spawning beginning in late spring and extending to early summer (Bestgen 1985, Propst 1999). In some instances in the upper basin, roundtail chub are found in breeding condition as late as July in years with extended high flows (Karp and Tyus 1990). In the upper Colorado River Basin, roundtail chub were observed spawning at temperatures within a range of 14-24°C (Kaeding et al. 1990). Other researchers in the upper Verde River and the Colorado River have observed spawning behavior in roundtail chub when water temperatures reached approximately 18°C to 22°C (Vanicek and Kramer 1969, Brouder et al. 2000). Spawning has also been associated with a descending hydrograph, when lower flows and warmer water temperatures become more prevalent (Bestgen 1985, Vanicek and Kramer 1969, Kaeding et al. 1990).

Roundtail chub in reproductive condition tend to display breeding coloration and tubercules. Color and tubercules are more prevalent and more intensely displayed in males that generally have bright red to orange around the cheeks and ventro-lateral surfaces of the head, abdomen, and paired anal fins (Minckley 1973, Propst 1999). Tubercules in males tend to cover most of the anterior body and fins and occasionally extend to the caudal peduncle and anal fin. Female coloration tends to be restricted to the bases of the paired fins (Bestgen 1985). Tubercules develop to a lesser degree around the head, pectoral fins, and between the dorsal fin and the head (Bestgen 1985, Propst 1999). Fecundity tends to be size dependent in roundtail chub (Propst 1999). Anecdotal evidence for this is given from Fossil Creek, where Neve (1976) observed females ranging from 100 to 260 mm in size that contained between 1,000 and 4,300 eggs. Brouder et al. (2000) observed females in the Verde River ranging from 270 to 427 mm that contained between 7,267 and 26,903 eggs. Brouder et al. (2000) also reported that the average female from this site measured 328 mm in length and contained 13,948 eggs.

Roundtail chub hatch approximately 5 to 7 days after fertilization (Muth et al. 1985). Propst (1999) observed that roundtails grew to lengths of 50 mm in the first year. For individuals in this study, growth began to slow at age 4, though by age 7 some individuals had attained lengths of 300 mm. Growth, fecundity, mortality, and a host of life history characteristics vary by locality; however, the period of greatest growth was consistently the first summer after hatching (Bestgen 1985). Brouder et al. (2000) found that late winter and early spring runoff was strongly correlated with survival of age-0 fish through their first year in the Verde River; this observation supports Bestgen's (1985) observation that late runoff delays spawning by adults and growth of progeny.

In the Gila River, adult roundtail chubs feed primarily on aquatic and terrestrial insects (including stoneflies, mayflies, caddisflies, and dipterans), but also on filamentous algae, crayfish, other fishes (Bestgen 1985). Roundtail chubs up to 170 mm fed primarily on macroinvertebrates and algae, and the diversity of consumed macroinvertebrates increased with fish size. Out of 17 roundtail chub over 170 mm caught in Turkey Creek, 14% consumed fish and 14% consumed crayfish. Young fish typically moved from slower water to the heads of pools to feed; adults fed away from the streambanks in run habitat with medium flows.

#### Interaction: competition

Apache trout, cutthroat trout, and rainbow trout.—Stocked Apache trout, cutthroat trout, and

rainbow trout may occupy the same stream reaches as roundtail chub. Due to similarities in diet and habitat preferences between trout and chub, competition for food or habitat, where limiting, is possible if the species co-occur.

Arctic grayling.—Natural reproduction of Arctic grayling in Arizona has not been documented and grayling survival is low due to winter freeze events and summer algae bloom events in stocking locations. However, because diets and habitat preferences overlap between Arctic grayling and Apache trout, there may be competition for food or habitat, where limiting, if they co-occur.

Black crappie.—Black crappie inhabits warmer sloughs, lakes, reservoirs and larger slow flowing rivers. Preferred habitat is lentic habitats with clear water and substantial vegetation (Moyle 2002, Pacey and Marsh 1998). While crappie is common in lakes and reservoirs, there are very few records of crappie establishing or persisting in streams or rivers in Arizona. However, because there are similarities in the diets of chub and crappie, competition for food or habitat, where limiting, is possible if they co-occur.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Aquatic insects are a major food source for both bluegill and roundtail chub. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and competition for food or habitat, where limiting, with roundtail chub is possible if they co-occur.

Brook trout and brown trout.—Due to similar habitat and diet preferences among brook trout, brown trout, and roundtail chub, competition for food or habitat, where limiting, is possible if they co-occur.

Channel catfish.—Macroinvertebrates are a major food source for channel catfish, especially for juveniles. Since macroinvertebrates are a major food source for roundtail chub, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preference between the species may reduce opportunities for competitive interactions.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass and are primary major food source for roundtail chub. This could lead to competition for food or habitat, where limiting if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preferences. However habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Because the diets of redear sunfish may contain aquatic insects, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences may reduce opportunities for competitive interactions.

Smallmouth bass.—This bass inhabits mid-order streams and lakes cooler in temperature, free of turbidity with shallow rocky areas, clear and gravel-bottom runs and flowing pools of rivers, cool

flowing streams and reservoirs fed by such streams. They prefer shady areas with submerged structures of stumps, trees or crevice within clay banks for retreat (Moyle 2002, Sublette et al. 1990). Severe temperature drops and siltation that occur during flood events may result in nest desertion and loss of eggs and fry. Smallmouth bass prefer rocky habitats in streams and lakes with clear waters. A portion of the smallmouth bass diet includes macroinvertebrates, thus competition for food or habitat, where limiting, is possible if they co-occur.

Threadfin shad.—In Arizona, threadfin shad are a small prey fish found primarily in reservoirs. Differences in habitat preferences between the two species may reduce the opportunity for competition. Because of some similarities in diet, competition for food or habitat, where limiting, is possible if they co-occur.

Walleye.—In Arizona, walleye inhabit several lakes and are generally bottom oriented fish due to their sensitivity to light. Competition between walleye and roundtail chub for habitat is unlikely since they occupy different habitat types in Arizona (lacustrine vs. fluvial). Competition between walleye and roundtail chub for food is not likely because of significant differences in diets.

#### Interaction: predation

Apache trout.— Apache trout are opportunistic feeders that consume primarily macroinvertebrates and piscivory has not been documented in stream systems. Thus, it is presumed that predatory interactions between stocked Apache trout and roundtail chub would be rare.

Arctic grayling.—Arctic grayling living in streams or lakes not associated with coastal drainages feed on drifting insects and may become planktivorous in lake systems (Sheuerell et al. 2007, Jones et al. 2003). Arctic grayling in Alaskan streams are known to feed opportunistically on salmon eggs, however, macroinvertebrates account for the majority of their diets (Eastman 1996). Natural reproduction of Arctic grayling in Arizona has not been documented; long-term persistence of the species has not been documented, nor is anticipated. Because persistence and piscivory in Arctic grayling have not been documented in stream systems in Arizona, it is presumed that predatory interactions between stocked Arctic grayling and roundtail chub would be rare.

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%. Given the feeding preferences of black crappie, predation on roundtail chub eggs, larvae, or juveniles could occur if the two species occupy the same habitat. Predation would likely be limited to these life stages of chub because adult crappie and roundtail chub are similarly sized. Since the occurrence of black crappie in streams is rare, the opportunities for predation may be reduced.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates),

predation by bluegill on roundtail chub is possible if the species co-occur. If predation occurs, it may be limited to the eggs, larvae, and juvenile chub due to size similarities between adult bluegill and adult roundtail chub.

Brook trout and brown trout.—Piscivory has been documented to range between 3-60% (Fraser 1981, Cunjak et al. 1987, L'Abée-Lund et al. 2002, Mistak et al. 2003, Sweka and Hartman 2008) and was documented in Arizona at 25% (Sweetser et al. 2002). A multitude of studies have documented piscivory in brown trout, both fluvial and lacustrine populations. Their piscivorous behavior, as well as its plasticity, is well documented and can vary significantly. Piscivory rates for brown trout in Arizona have been documented at 33% (Sweetser et al. 2002). Because stocked brown trout and brook trout and adult roundtail chub are of similar sizes, predation by brown or brook trout may be limited to the egg, larvae, or juvenile life stages of chubs.

Channel catfish.---Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on roundtail chub is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on roundtail chubs is possible if they co-occur. The occurrence of interactions may be reduced due to differences in habitat preferences. However habitat use may overlap when preferred habitat is not available.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur and would likely be limited to eggs, larvae, and juvenile chub due to size similarities between adult sunfish and chub.

Smallmouth bass.—Young feed on plankton, immature aquatic insects, and fish while adults take in crayfish, fish, and aquatic and terrestrial insects in lakes and streams. Piscivory rates for smallmouth bass have been documented to range between 3.4-100%, with rates varying by size, season, and location (Mittelbach and Persson 1998, Olson and Young 2003, Bonar et al. 2004, Fritts and Pearsons 2004, Naughton et al. 2004). Bonar et al. (2004) documented piscivory rates in smallmouth bass to be less than 4% (n = 1441) and most fish consumed were nonnative fish (2.8% nonnative, 0.7% native, 0.7% unknown). Because smallmouth bass may be highly piscivorous, predation on roundtail chub is possible if the species co-occur. If predation occurs, it will likely be upon eggs, larvae, or juvenile chub because of size similarities between adult smallmouth bass and roundtail chub.

Threadfin shad.—Threadfin shad are feed primarily on plankton in open limnetic waters; however some bottom feeding does occur and adults may prey upon fish larvae (Baker and Schmitz 1971). In Lake Chicot, Arkansas the primary constituents of the threadfin shad diet were algae (54%) and animal material (49.5%) with most of algae diet containing green algae (Chlorophyta) and most of the animal material consisting of protozoans and invertebrate eggs

(Miller 1967). Because predation by threadfin shad on fish larvae has only been documented in lacustrine habitats, negative predatory interactions between threadfin shad and stream-dwelling roundtail chubs would be rare.

Walleye.—The diets of walleye in western Lake Erie fluctuated with the seasonal availability of forage fish (Knight et al 1984.). Walleye older than 1 year were predominately piscivorous, consuming shiners, clupeids, and spiny-rayed fishes depending on seasonal availability. Walleye prefer fish but will eat crayfish and worms. In Arizona, their main diet is threadfin shad (Minckley 1973). If interactions between walleye and roundtail chubs do occur, predation by walleye on chubs of any life stage is possible.

### **Spikedace**

Interaction species: Black crappie, bluegill, brook trout, brown trout, channel catfish, largemouth bass, rainbow trout, redear sunfish

#### **Habitat preferences and diet of spikedace**

Spikedace can be found in moderate to large perennial streams; it inhabits shallow riffles, with sand and gravel substrates, and moderate to swift currents and pools over sand or gravel substrates (Barber et al. 1970, Propst et al. 1986, Rinne 1991). Spikedace microhabitat preferences include shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand or gravel bars, and eddies of downstream riffle edges (Propst et al. 1986, Rinne and Kroeger 1988). Juveniles prefer slow to moderate flow velocities in shallow water with moderate amounts of instream cover. Larval spikedace are found in slow to moderate flow in shallow water with abundant instream cover.

Spikedace breeding occurs over shallow (8-15 cm deep), sand bottomed areas with moderate flow. Spawning begins in March when water temp reach 19°C, and proceeds until June, but mature ovaries have been detected in female fish through September (Minckley 1981). Macroinvertebrates are the primary food source for spikedace, specifically baetid ephemeropterans (mayfly), Hydropsychid trichopterans (net-spinning caddisflies), Chironomid dipterans (midges), and Simuliid dipterans (black flies) (Anderson 1978, Schreiber and Minckley 1981, Barber and Minckley 1983).

#### **Interaction: competition**

Black crappie.—Both black crappie and spikedace feed on macroinvertebrates which could lead to competition for food or habitat, where limiting, if they co-occur. However, since the occurrence of black crappie in streams is rare, the opportunities for competition may be reduced.

Bluegill.—Bluegill prefer static, clear ponds, reservoirs and sluggish streams with adults preferring warmer waters with rooted aquatic vegetation. In Arizona, bluegill are found in reservoirs or ponds below 8,200 ft. in elevation, and rarely occur in stream or rivers. Aquatic insects are a major food source for both bluegill and spikedace. Although there are differences in habitat preferences between species, bluegill diets consist primarily of invertebrates and

competition for food or habitat, where limiting, with spikedace is possible if they co-occur.

Channel catfish.—Macroinvertebrates are a major food source for channel catfish, especially juveniles. Since macroinvertebrates are a major food source for spikedace, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences between the species may reduce opportunities for competition.

Largemouth bass.—Aquatic insects are a component of the diet of largemouth bass and are a major food source for spikedace. Thus, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences between the species may reduce opportunities for competition. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Since hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates, competition for food or habitat, where limiting, is possible if they co-occur. Differences in habitat preferences and temperature tolerances between the species may reduce opportunities for competition. Long-term survival of stocked rainbow trout would not be expected due to high summer water temperatures in spikedace habitat.

Redear sunfish.—Because redear sunfish diets contain aquatic insects, competition for food or habitat, where limiting, is possible if they co-occur. However, redear sunfish prefer clear waters of lakes, reservoirs, or ponds and are usually associated with cover (Moyle 2002). Pacey and Marsh (1998) also include rivers and streams as potential habitat, with microhabitat preferences of deeper, slow or slack water habitats (e.g., deep pools, eddies, and shoreline cut banks). They are not reported in riffle, run, or glides, and avoid turbidity. Since spikedace prefer shallow, flowing water (Minckley 1973) the opportunity for competition with redear sunfish may be reduced.

#### Interaction: predation

Black crappie.—Young black crappie feed on small invertebrates, including microcrustaceans and small insects, but prey on fishes as they mature. Based on diet analyses of many studies (see references in Background), piscivory rates have been documented to range between 8-60%. Given the feeding preferences of black crappie, predation on spikedace is possible if they co-occur. The occurrence of black crappie in streams is rare, which may reduce opportunities for predation on spikedace.

Bluegill.—Although there are differences in general habitat preferences between species, and dietary studies indicate bluegill are not very piscivorous (feeding primarily on invertebrates), predation by bluegill on spikedace is possible if they co-occur.

Channel catfish.—Channel catfish consume primarily macroinvertebrates, yet piscivory rates increase with fish size; thus, predation would be more common in large catfish and uncommon in juvenile catfish. Because juvenile channel catfish feed primarily on macroinvertebrates, predation on chub eggs, larvae, and juveniles would be rare. Larger channel catfish can be more piscivorous, thus, predation on spikedace is possible if the species co-occur.

Largemouth bass.—Largemouth bass are highly piscivorous; thus, predation by stocked largemouth bass on spiketail is possible if they co-occur. Differences in habitat preferences between the species may reduce opportunities for predation. However, habitat use may overlap when preferred habitat is not available.

Rainbow trout.—Hatchery-reared rainbow trout are opportunistic feeders that primarily consume macroinvertebrates. However, the literature documents a range in piscivory in stocked rainbow trout (0-9%). Thus, predation by rainbow trout on spiketail is possible if they co-occur. Differences in habitat preferences and temperature tolerances between the species may reduce opportunities for competition. Long-term survival of stocked rainbow trout would not be expected due to high summer water temperatures in spiketail habitat.

Redear sunfish.—Redear sunfish diets consist primarily of benthic organisms including insects, crustaceans, and small clams. Piscivory in redear sunfish has rarely been documented; however, predation is possible if they co-occur.

### Interactions between stocked fish and amphibians and reptiles

#### Arizona Tree Frog

*Interaction species: Largemouth bass, bluegill, redear sunfish, channel catfish, rainbow trout*

Arizona tree frogs are active from late June to early October and use mesic habitats such as shaded oak groves, wet seeps, and other moist locations (Holm and Lowe 1995). Breeding takes place primarily in ephemeral waters. Although they sometimes use permanent sites, such as stock tanks, they are less likely to support treefrog larvae because of the increased presence of aquatic invertebrate and vertebrate predators, including predatory insects, crayfish, bullfrogs or fish species (Collins 1996).

#### Competition

While specific data are not available for Arizona tree frogs, tree frogs (*Hyla* spp.), in general, primarily prey on a variety of terrestrial invertebrates, and do so primarily in terrestrial habitats (e.g., Oplinger 1967). Adults occupy aquatic habitats only during breeding activity, and are not likely to feed at that time. Treefrog larvae feed on aquatic algae, bacteria and detritus. Therefore, competition between adult or larval Arizona tree frogs and stocked fish species is unlikely.

#### Predation

The Arizona treefrog is active from April to October, and moves to breeding sites during the summer monsoon season. Arizona tree frogs typically breed in ephemeral sites that fill with summer rainfall. There is minimal potential for exposure with the stocked species at breeding sites, and overlap would be of short duration, and only in the unusual case in which a treefrog would stray into a stocked site. In addition, trout stocking season is from October to April thus minimizing potential contact.

There are no movement data for Arizona tree frogs, so the extent to which they are likely to move to sites with stocked fish is unknown. Studies of other, ecologically similar and similarly-sized species of hylid frogs provide a conservative basis for comparison. Maximum movement distances have been reported for pine barrens tree frogs (102 m), gray tree frogs (about 300 m) and western chorus frogs (about 200 m) (Freda and Gonzalez 1986, Johnson et al. 2007, Kramer 1973), all of which breed in ephemeral waters and spend most of the non-breeding season feeding in adjacent forests. Importantly, all of those species occur in more mesic habitats in the eastern U.S., which would facilitate terrestrial movements. Thus, we conservatively suggest that Arizona tree frogs might move up to 300 m from breeding sites.

The distribution of Arizona tree frogs in and around the Huachuca Mountains is incompletely understood (USFWS 2008c). Nearest known breeding sites include Hannah Tank (1.7 km [1.05 mi] E of Parker Canyon Lake) and Whiner Tank (2.9 km [1.8 mi] N of Parker Canyon Lake); other nearby sites include those in Scotia Canyon northeast of the lake > 3 km (> 1.9 mi) (USFWS 2008c). Although these known sites are farther than 300 m from Parker Canyon Lake, we do not know if there are populations of Arizona tree frogs closer to the lake. Thus, it is possible that Arizona tree frogs could enter Parker Canyon Lake, but we do not know how likely that would be.

Although there are no definitive data to address pre-breeding behavior in Arizona tree frogs, one would expect there to be strong selection against individuals that would enter permanent water, such as an impoundment with a large population of potential predators. Surprisingly few experiments have tested the generality of this hypothesis. Experiments with other similarly-sized species of hylid frogs that also breed in ephemeral waters (e.g., gray tree frogs) have shown that predation pressures in permanent waters typically prevent those treefrog species from entering potential breeding sites that harbored predators (Resetarits and Wilbur 1989). This suggests that a stocked site would not provide suitable habitat for Arizona tree frogs due to the presence of predatory, nonnative fishes already present. Nonetheless, studies of some ranid frogs suggest that choice of egg-laying sites with or without predatory fishes differs among different species, i.e., some species avoid sites with fishes, others do not (Hopey and Petranks 1994, Laurila and Aho 1997). In the Canelo Hills north of Parker Canyon Lake there is a record of an Arizona treefrog at a stock tank that supported exotic fishes, and had for many years (AGFD Sonoran tiger salamander database, T. Jones and A. Owens, pers. comm.), suggesting that avoidance of such habitats is not perfect.

Any dispersing Arizona treefrog that moves into a stocking site is at risk of predation by largemouth bass, channel catfish and rainbow trout. Hovey and Ervin (2005) reported juvenile largemouth bass predation on a California treefrog (*Pseudacris cadaverina*), a species about the same size as the Arizona treefrog. Matthews et al. (2001) documented a strong negative correlation between the distribution of Pacific tree frogs (ecologically similar to Arizona tree frogs) and introduced nonnative trout species (*Onchorhynchus* spp.), and suggested that predation was the probable cause.

### Baitfish/Live Bait Issues

Use of live baitfish or tiger salamanders is prohibited at Parker Canyon Lake. The habitats of the



Arizona tree frog in the Huachuca Mountains are in both perennial and ephemeral waters that may be at risk for illegal baitfish introduction (USFWS 2008c). Arizona tree frogs are unlikely to persist in large numbers where there are bullfrogs or nonnative fish species. For example, experiments have demonstrated that predation by mosquitofish (*Gambusia* sp.) had a disproportionately greater effect on hylid frog tadpoles than did other similarly-sized native and nonnative fishes (Baber and Babbitt 2003). Nonetheless, overlap with nonnatives has been observed. For example, bullfrogs were observed seasonally in an Arizona treefrog breeding site in the Huachuca Mountains, but those bullfrogs had also consumed several adult Arizona tree frogs (Jones and Timmons in review). In June 2008, an adult Arizona treefrog was seined out of Turkey Tank in the Canelo Hills from which over 1200 green sunfish had also been seined (A. Owens, pers. comm.). Exotic fishes have been documented at that site over many years, including 1995 (T. Jones, pers. comm.), 1997 and 2006 (AGFD Salamander database). Thus, tree frogs might persist at low numbers with exotic predators for many years until the treefrog population has been completely depleted.

### Chiricahua Leopard Frog

Interaction species: Rainbow trout, brook trout, cutthroat trout, brown trout, Apache trout, channel catfish, Arctic grayling, largemouth bass, bluegill sunfish, redear sunfish, yellow perch, walleye, black crappie, flathead catfish.

The Chiricahua leopard frog (*Rana chiricahuensis*) is a large member of the *Rana pipiens* complex that is found in a variety of permanent and semi-permanent aquatic habitats in Arizona, New Mexico, Sonora and Chihuahua. The primary threats to this species are predation by nonnative, introduced bullfrogs, fish, and crayfish, and an introduced fungal skin disease (chytridiomycosis) that is implicated in global decline of frogs and toads. Other limiting factors include drought, floods, habitat degradation, loss and fragmentation, populations that are small in number and size, environmental contamination, poor livestock management, and altered fire regimes (USFWS 2007).

Chiricahua leopard frogs, like other leopard frogs, are typically habitat generalists, found in springs, cienegas, canals, small creeks, main stem rivers, lakes, and earthen cattle tanks. This species is the most aquatic of all Arizona leopard frogs and requires permanent to semi-permanent water to survive and reproduce. Important habitat requirements are typically heterogeneous in nature and generally include shallow water with emergent vegetation for breeding and deeper water, undercut banks and other structure for escaping predators (Sredl and Jennings 2005, USFWS 2007).

Larval Chiricahua leopard frogs are herbivorous, feeding on bacteria, diatoms, phytoplankton, filamentous green algae, water milfoil (*Myriophyllum* sp.), duckweed (*Lemna minor*), detritus and likely feed on other aquatic vegetation (USFWS 2007). Adults consume a wide variety of insects and other arthropods (Degenhardt et al. 1996), and they occasionally consume small vertebrates, including other amphibians and birds (Stebbins 1951).

The Chiricahua leopard frog has a complex life cycle: they are aquatic as larvae and become terrestrial as adults. Breeding may occur any time of the year. Eggs are deposited in shallow

water and are attached to vegetation or sometimes to the bottom substrate. Chiricahua leopard frog tadpoles can metamorphose in 3 months, but may over winter, taking up to 9 months or more to metamorphose (Sredl and Jennings 2005).

### Predation

Studies that have implicated nonnative fish in declines of Chiricahua and other leopard frogs in Arizona include Clarkson and Rorabaugh (1989), Sredl and Howland (1994), Rosen et al. (1994, 1996), and Snyder et al. (1996). These studies and the Chiricahua leopard frog recovery plan (USFWS 2007) identify predation by nonnative fish as one of the primary threats to the Chiricahua leopard frog. Specifically, predation by stocked fish in the family Centrarchidae (e.g., *Micropterus* spp., *Lepomis* spp.) is thought to have the most dramatic impact on Chiricahua leopard frog larvae, metamorphs, and adults. Additionally, other species such as catfishes (*Ictalurus* spp.), the flathead catfish (*Pylodictus olivaris*), and species of trout (*Oncorhynchus* spp. and *Salvelinus* spp.) are thought to prey upon life stages of the Chiricahua leopard frog. The interactions of stocked trout and Chiricahua leopard frogs have been poorly studied. However, examining the interactions of other ranid frog species and trout may provide some insight. The best studied “trout-frog” interaction is that between the mountain yellow-legged frog (*Rana muscosa*) in high lakes of the Sierra Nevada, California and stocked trout (*Oncorhynchus* spp. and *Salvelinus* spp.). Several authors have concluded that predation by these introduced species into the previously fishless lakes of the High Sierra have eliminated populations of mountain yellow-legged frogs (Bradford 1989, Bradford et al. 1993, Knapp and Mathews 2000, Vredenburg 2004).

Whether introduced trout would have the dramatic impact to Chiricahua leopard frogs as they did on mountain yellow-legged frogs is unclear for several reasons: 1) the High Sierra lakes occupied by the mountain yellow-legged frog were historically fishless, while the aquatic habitats historically occupied by the Chiricahua leopard frogs often contained fish, including native trout of the genus *Oncorhynchus*; 2) the High Sierra lakes are oligotrophic, with extremely high visibility and little vegetative cover, while aquatic systems that the Chiricahua leopard frog occupies are usually eutrophic, with poor visibility and good cover; and 3) mountain yellow-legged frogs in the High Sierra lakes have a 3-year larval period, while Chiricahua leopard frogs have, at most, a 1-year larval period.

It is worthwhile noting that most of the studies that have examined the interactions of nonnative fish and native leopard frogs base their conclusions on the negative co-occurrence of “fish and frogs” in the wild. Because of this, they provide limited insight into environmental conditions that mediate interactions or techniques to mitigate impacts between these taxa. However, in spite of the lack of details on the mechanics of these interactions, there is universal agreement the impacts of stocked fish on native aquatic organisms can be serious and dramatic.

### Competition

Populations of Chiricahua leopard frogs and stocked fishes are unlikely to persist syntopically. However, if they did co-occur they may attempt to utilize some of the same resources, most notably food and space. Utilizing shared resources is not competition - for competition to occur, there must be a limited shared resource.

Chiricahua leopard frogs are known to inhabit aquatic habitats ranging from cienegas, stock tanks, small ponds, streams, and rivers. The best habitats are heterogeneous, with deep and shallow water, aquatic and emergent vegetation, root masses or other forms of cover (USFWS 2007). These are often highly productive systems with abundant plant and animal life, making the likelihood that “fish and frogs” will compete for food resources low.

With water being a limited resource, competition for space within aquatic sites is more likely. Both frogs and stocked fish will utilize slow and slack water habitats (pools, eddies etc.) and while competition under these circumstances is possible, the consequences of predation are likely to be far more severe.

### Bait fish issues

Most legal baitfish likely have little impact on native leopard frogs. Mosquitofish occupy all of the ponds at the Beatty Guest Ranch in the Huachuca Mountains, which support the largest and most robust populations of Chiricahua leopard frogs in the state. This suggests that predation by mosquitofish may be insignificant; however, the coexistence of these species could be influenced by other factors, such as abundant escape cover, high adult frog survivorship, and high reproductive output in terms of numbers of frog egg masses produced. Goldfish occupy Butch Tank, Coconino Co, which also contains a robust population of northern leopard frogs (M. Sredl pers. comm.).

Illegal stocking of earthen cattle tanks and other bodies of water to create bait fish populations can have a significant effect to leopard frogs, particularly when highly predaceous species are planted. Most areas of Chiricahua leopard frog occurrence are outside of locations where bait fish are legal to use. However, legal use of bait in the Gila, Salt, and Verde rivers and associated reservoirs can lead to illegal creation of bait fish populations in tanks within those watersheds.

### Narrow-headed gartersnake

Interaction species: Rainbow trout, brown trout, brook trout, cutthroat trout, Arctic grayling, Apache trout, smallmouth bass, largemouth bass, bluegill, redear sunfish, black crappie, channel catfish, threadfin shad

Narrow-headed gartersnakes occupy primarily large, perennial streams and depend on rocky riffles for foraging and bank-side vegetation for basking and escape from predators (Rosen and Schwalbe 1988; Rossman et al. 1996). These snakes feed almost exclusively on soft-rayed fishes and rarely move more than a few meters from the edge of these streams (Nowak and Santana-Bendix 2002, Nowak 2006). Hibbitts et al. (2009) explained that habitat specialists, such as narrow-headed gartersnakes, are highly susceptible to changes in their habitat, and introductions of nonnative fishes and streamside trampling from recreational use changes the microenvironment on which these snakes depend. Throughout their range in Arizona and New Mexico, narrow-headed gartersnakes have experienced significant population declines (Holycross et al. 2006, Pierce 2007). The introduction of nonnative species, including sport fish, is thought to be a major threat and cause for population declines (Rosen and Schwalbe 1988, Rossman et al. 1996, Nowak and Santana-Bendix 2002), although the mechanisms through

which these occur are incompletely understood.

The likely mechanisms by which nonnative species interact with narrow-headed gartersnakes are through predation, competition and habitat modification, though the degree to which either occurs is unclear. There is a strong negative correlation between sport fish (especially spiny-rayed fishes) and narrow-headed gartersnakes (Rosen and Schwalbe 1988, Nowak and Santana-Bendix 2002, Holycross et al. 2006, Pierce 2007). Nonnative spiny-rayed fishes are thought to be unsuitable prey because narrow-headed gartersnakes cannot safely ingest the fish without them becoming lodged in their throats or causing other physical damage to the digestive tract (Nowak and Santana-Bendix 2002).

During gartersnake surveys at 7 Arizona sites in the mid-1980s, narrow-headed gartersnakes were only abundant in areas where native fish predominated (Rosen and Schwalbe 1988). Rosen and Schwalbe (1988) surveyed Oak Creek in 1985 and 1986 and hypothesized that the abundance of narrow-headed gartersnakes in Oak Creek Canyon reflected the lack of introduced predatory fish. During gartersnake surveys in the lower reaches of Oak Creek Canyon in 2000-01, narrow-headed gartersnake populations were very low or undetectable. In those reaches, nonnative spiny-rayed fishes, bullfrogs and crayfish were detected (Nowak and Santana-Bendix 2002). Nowak and Santana-Bendix (2002) suggested that the abundance of spiny-rayed nonnative fishes in the lower reaches of the canyon (along with the loss of suitable prey) accounted for the decline of narrow-headed gartersnakes in those areas. Although these data are correlative, the correlations are strong and suggest that the introduction of nonnative fishes is directly or indirectly responsible for changes in gartersnake numbers, although other related factors might also be involved.

### Competition

There is potential for nonnative sport fish to interact with narrow-headed gartersnakes through competition for food and habitat, though the degree to which this occurs is unknown. For example, piscivorous largemouth and smallmouth bass and various catfish species readily prey on other fishes, as will some trout species, and thus could compete with gartersnakes for food where these shared resources are limited. Narrow-headed gartersnakes prey primarily on small soft-rayed fishes (Nowak and Santana-Bendix 2002), including native suckers and speckled dace, and nonnative rainbow and brown trout and red shiner. To a lesser extent, narrow-headed gartersnakes may prey on some spiny-rayed fishes such as sunfish and smallmouth bass (Degenhardt et al. 1996, Pierce 2007, M. Lopez pers. comm.). In captive situations, narrow-headed gartersnakes have also been documented to prey on larval and adult anurans and larval tiger salamanders (Degenhardt et al. 1996). Competition for prey is likely to occur between narrow-headed gartersnakes and piscivorous fishes, including smallmouth bass and, to a lesser extent (because of habitat partitioning), largemouth bass and channel catfish where prey resources are limited.

### Predation

There is potential for nonnative stocked sport fish to interact with narrow-headed gartersnakes through predation. Sportfish that consume vertebrate prey species (e.g., largemouth bass, smallmouth bass, channel catfish) likely prey on neonate and juvenile gartersnakes (Rosen and

Schwalbe 1988, Schindler et al. 1997, Rosen et al. 2001). For example, Winemiller and Taylor (1982) reported aggressive attacks by nesting smallmouth bass directed towards common gartersnakes (*Thamnophis sirtalis*), though it is unclear whether these attacks were attempted predation or competition for habitat. Additionally, an overlap in habitat preferences will increase the likelihood of interaction between stocked sport fish and narrow-headed gartersnakes. For example, in Arizona, smallmouth bass are more likely than other piscivorous fishes to overlap in habitat with narrow-headed gartersnakes because they prefer clear, gravel-bottom runs in rivers and cool flowing streams. The frequency at which these species could interact is higher than for other stocked sport fish and may result in predation on the snakes or competition for food and habitat.

Apache and rainbow trout prey primarily on invertebrates (Metcalf et al. 1997) and are not considered important predators on vertebrates (Rosen and Schwalbe 1988). Historically, native trout (Apache and Gila) species and narrow-headed gartersnakes co-occurred across much of their distribution in Arizona, and it is likely that they evolved to co-exist. It is not known what effect the presence of nonnative trout has on narrow-headed gartersnakes. However, during 2009 surveys at Oak Creek, Brennan and Rosen (2009) observed that narrow-headed gartersnake occurrence was negatively associated with the presence of brown trout (presumably large trout) throughout the main stem and other tributaries of Oak Creek Canyon.

The stocking of sport fish might also result in positive interactions for narrow-headed gartersnakes, because, as described above, the snakes will prey on some species. In a diet analysis of narrow-headed gartersnakes, Nowak and Santana-Bendix (2002) found brown trout in 8 of 12 snakes that had food in their stomachs. Additionally, Nowak (2006) demonstrated that narrow-headed gartersnakes in the upper reaches of Oak Creek apparently prefer immature brown trout. Narrow-headed gartersnakes thrive in captivity on a diet of fingerling rainbow trout (V. Boyarski pers. comm.). The stocking of fingerling trout could provide additional food sources to the snakes in areas where native prey species have been severely reduced.

### Angler Impacts/Baitfish/Live Bait Issues

Recreational activities, such as fishing and access to stocking sites, may increase as the result of the sport fish stocking action and these activities could directly and indirectly impact narrow-headed gartersnake populations and their habitats. Angler/recreational use might increase the likelihood of direct mortality as well as habitat changes from streamside/vegetation trampling and the intentional/unintentional spread of nonnative live bait (e.g., baitfish, crayfish, etc.).

As is common in many cultures, people often dislike snakes because they believe snakes are venomous and a threat to their safety. As a result, people with such misperceptions intentionally kill snakes, including narrow-headed gartersnakes, even though they are not venomous (Nowak and Santana-Bendix 2002). In addition, some anglers believe that narrow-headed gartersnakes compete with sport fish, and therefore might kill the ones they encounter (Pierce 2007).

Rosen and Schwalbe (1988) documented substantial human-caused mortality on narrow-headed gartersnakes at Oak Creek Canyon, a site used heavily by recreationists. Nowak and Santana-Bendix (2002) also reported high rates of direct mortality on narrow-headed gartersnakes at sites within Oak Creek that receive high recreational use (e.g., Slide Rock State Park), but they did not consider the overall impact of recreation on the population to be large. During interviews with

bathers at Oak Creek Canyon, Rosen and Schwalbe (1988) found that people commonly caught narrow-headed gartersnakes and took them to Flagstaff, presumably for pets. Nowak (2006) also reported that visitors to Oak Creek, especially children, collected the snakes to keep as pets, despite outreach signs designed to explain the conservation needs of the snakes and to reduce negative snake-human interactions. Nowak and Santana-Bendix (2002) also documented other sources of direct human caused mortality of narrow-headed gartersnakes from recreationists and from vehicles at stream crossings, as well as entanglement in fishing line.

Oak Creek Canyon receives atypically heavy use since certain reaches are popular for hiking, bathing, and/or fishing. Therefore, additional impacts by recreationists/anglers might also degrade habitat conditions along streams where the snakes occur. Narrow-headed gartersnakes inhabit submerged interstitial spaces in emergent boulders within streams, a microhabitat that is vulnerable to degradation or elimination from heavy siltation (Rosen and Schwalbe 1988), which typically results from large scale soil erosion (e.g., that might result after catastrophic wildfires). Rosen and Schwalbe (1988) found only one instance of heavy siltation of narrow-headed gartersnake habitat (Cibecue Creek), and attributed it to channelization associated with agriculture. More recently, however, Oak Creek Canyon has experienced siltation caused by heavy recreational use. Nowak (2006) cited recreation-caused destruction of nursery habitat for neonate snakes and their prey fish as a factor contributing to the decline of the species in Oak Creek Canyon, however, this has not been experimentally tested.

Habitat impacts might also result from intentional or unintentional spread of nonnative live bait. While use of live baitfish or tiger salamanders is prohibited in some parts of the state, it is still permitted in many areas. Crayfish and bullfrogs cannot be legally moved alive among most Arizona waters including those within the range of narrow-headed gartersnakes. However, despite these restrictions, some anglers may still use these for bait and could move crayfish and bullfrogs among aquatic systems. Anglers may also transport live baitfish or salamanders among waters and they may come in contact with narrow-headed gartersnakes.

There is considerable correlative evidence that suggests crayfish negatively impact narrow-headed gartersnakes. Nowak and Santana-Bendix (2002) observed that narrow-headed gartersnakes were less likely to be found in streams with crayfish. During 2009 gartersnake surveys along the Black River, narrow-headed gartersnakes were found in very low numbers where crayfish densities were high, and narrow-headed gartersnakes appeared to continue to decline at that site (Brennan and Rosen 2009). Crayfish also prey on other small aquatic vertebrates (Fernandez and Rosen 1996, Schwendiman 2001) and possibly compete with gartersnakes for prey. Crayfish remove aquatic vegetation (Saiki and Zeibell 1976, Fernandez and Rosen 1996), which could directly affect gartersnake prey species and their habitat. If given the opportunity, crayfish prey on, or at least attempt to prey on gartersnakes, especially neonates (Fernandez and Rosen 1996). At 3 of 5 sites at which narrow-headed gartersnakes were found during 2004-05 surveys, most snakes had scars or incomplete tails, injuries that were attributed to attempted predation by crayfish (Holycross et al. 2006), and consistent with experimental evidence (Fernandez and Rosen 1996). Furthermore, only 3 of 19 narrow-headed gartersnakes found in the Black River in 2009 had complete tails (Brennan and Rosen 2009). When foraging, narrow-headed gartersnakes use their tails to anchor themselves between boulders (V. Boyarski pers. comm.), and having an incomplete tail could decrease foraging effectiveness and therefore



survivorship.

Bullfrogs have been implicated in the decline of other gartersnake species in Arizona (Rosen and Schwalbe 2002), and bullfrog presence was cited as one of several factors causing the decline of narrow-headed gartersnakes in the lower reaches of Oak Creek Canyon (Nowak 2006). Although direct predation of narrow-headed gartersnakes has not been documented, bullfrog predation on other gartersnake species has been documented (Schwalbe and Rosen 1988, V. Boyarski pers. comm.).

### Northern Mexican Gartersnake

Interaction species: Rainbow trout, brook trout, cutthroat trout, Arctic grayling, Apache trout, largemouth bass, bluegill, redear sunfish, black crappie, channel catfish, brown trout, threadfin shad, flathead catfish

Northern Mexican gartersnakes are semi-aquatic, riparian obligates that inhabit cienegas, streams, rivers, stock ponds and other aquatic habitats with dense vegetation, and they feed primarily on a varied diet of native aquatic species (e.g., adult and larval native leopard frogs, native fishes) (Rosen and Schwalbe 1988, USFWS 2008b). Gartersnakes will prey opportunistically on toads, tree frogs, earthworms, deer mice, lizards, and tiger salamanders (USFWS 2008b) as well as on some nonnative species, particularly juvenile soft-rayed fishes, such as mosquitofish, and young bullfrogs (Holycross et al. 2006, V. Boyarski pers. comm.).

The introduction of nonnative species, such as bullfrogs, crayfish and sport fish (e.g., channel catfish, largemouth bass) is believed to have contributed to the decline of northern Mexican gartersnake populations throughout Arizona. Rosen et al. (2001) stated that gartersnake declines “have been associated with high-density bullfrog populations, predatory centrarchid fishes, and disappearance of primary prey—native ranid frogs and native fishes.” The likely mechanisms by which these nonnative species interact with gartersnakes are through predation, competition, and habitat modification, though the degree to which any occurs has not been thoroughly documented. Also, attempts to prey on spiny-rayed nonnative fish may result in injury or death due to choking or injury from spines (e.g., as has been reported for narrow-headed gartersnakes Nowak and Santana-Bendix 2002, USFWS 2008b).

### Competition

There is potential for nonnative sport fish to interact with northern Mexican gartersnakes through competition where shared resources are limited, though the degree to which this occurs is unknown. For example, rainbow trout, one anticipated species proposed for stocking, feed primarily on invertebrates and could compete with native leopard frogs for food. Through their impacts on frog populations, trout could affect gartersnakes. Additionally, some trout species (e.g., brown trout) also prey on frogs and therefore could compete with northern Mexican gartersnakes for prey. Rosen and Schwalbe (1988) suggested that nonnative fishes, such as large catfish, bass and pike, might have contributed to the decline of native leopard frogs and small native fish, which are important prey species for gartersnakes.

In a California study, Matthews et al. (2002) evaluated the potential links among declining

amphibians, nonnative trout (e.g., *Oncorhynchus mykiss* x *Oncorhynchus mykiss aguabonita* hybrids, *Salvelinus fontinalis* and *Salmo trutta*) introductions and the distribution of mountain gartersnakes (*Thamnophis elegans elegans*) in high elevation aquatic communities. Strong positive associations were observed between the presence and numbers of native anurans (*Pseudacris regilla*, *Rana muscosa*, and *Bufo spp.*) and the presence of mountain gartersnakes. In lakes where amphibians were declining or from which they had disappeared, few to no gartersnakes were found. Matthews et al. (2002) reported a significant negative association between snake presence and presence of nonnative trout in the high elevation lakes. They surveyed 2103 lakes and ponds, and although they did not discount the possibility that trout occasionally preyed on snakes, none were found in stomach contents of >1200 fish. Matthews et al. (2002) commented that, “we suspect that the distribution of amphibian prey may be the primary factor determining snake distribution and abundance among lakes.” Thus they concluded that introduced trout competed with gartersnakes for native amphibians, and by reducing the prey populations the trout had caused reductions in gartersnakes.

### Predation

There is potential for nonnative stocked sport fish to interact with northern Mexican gartersnakes through predation. Sportfish that consume vertebrate prey species (e.g., largemouth bass, channel catfish, etc.) likely prey on neonate and juvenile gartersnakes (Rosen and Schwalbe 1988, Rosen et al. 2001). For example, Winemiller and Taylor (1982) reported aggressive attacks by nesting smallmouth bass directed towards common gartersnakes (*Thamnophis sirtalis*), though it is unclear whether these attacks were attempted predation or competition for habitat. We are not aware of any documentation of nonnative fish preying on northern Mexican gartersnakes, and more information is needed on this subject.

Rainbow trout prey primarily on invertebrates (Metcalf et al. 1997) and are not considered important predators on vertebrates (Rosen and Schwalbe 1988). It is not known what effect, if any, the presence of these nonnative trout has on northern Mexican gartersnakes. Additionally, the likelihood and frequency of interactions between stocked trout and snakes depends on the time of year that stocking occurs. Often, rainbow trout are stocked in reservoirs during the cool season months when snakes are in hibernation, and the trout are not expected to persist through the summer months when water temperatures exceed their thermal tolerance. Also, large rainbow trout maintained in a pond at the Page Springs state fish hatchery have not been observed to prey on northern Mexican gartersnakes, though trout stomach contents have not been examined (V. Boyarski pers. comm.).

Sportfish stocking could result in positive interactions for northern Mexican gartersnakes, because, as described above, the snakes will prey on some stocked species of soft-rayed fishes. Neonate gartersnakes at the Bubbling Ponds fish hatchery frequently consume nonnative mosquitofish, though these are not proposed for stocking (V. Boyarski pers. comm.).

### Angler Impacts/Baitfish/Live Bait Issues

Recreational activities, such as fishing and access to stocking sites, may increase as the result of the sport fish stocking action and these activities could directly and indirectly impact northern Mexican gartersnake populations and their habitats. Angler/recreational use might increase the



likelihood of direct mortality as well as habitat changes from bank-side vegetation trampling and the intentional or unintentional spread of nonnative live bait (e.g., baitfish, crayfish, etc.). As is common in many cultures, people often dislike snakes because they believe snakes are venomous and a threat to their safety. As a result, people with such misperceptions intentionally kill snakes, even if they are not venomous (e.g., as has been reported for narrow-headed gartersnakes, Nowak and Santana-Bendix 2002). In addition, some anglers might believe that gartersnakes compete with sport fish, and therefore might kill the ones they encounter (Pierce 2007). The degree to which direct mortality to northern Mexican gartersnakes occurs is unknown.

Habitat impacts might result from intentional or unintentional spread of nonnative live bait. Northern Mexican gartersnake populations in the Verde River, Oak Creek, and Tonto Creek occupy areas where use of live bait is permitted (e.g., sunfishes, fathead minnow, threadfin shad, red shiner, mosquitofish, carp, etc.). Crayfish and bullfrogs cannot be legally moved alive among most Arizona waters including those within the range of northern Mexican gartersnakes. However, despite these restrictions, some anglers may still use these for bait and could move crayfish and bullfrogs among aquatic systems. Anglers may also transport live baitfish or salamanders among waters and they may come in contact with gartersnakes.

There is considerable evidence that suggests that bullfrogs negatively impact northern Mexican gartersnakes through predation and competition and they have been implicated in the species' decline in Arizona (Rosen and Schwalbe 1988; V. Boyarski pers. comm.). During surveys in the late 1980s, Rosen and Schwalbe (1988) found a disproportionate number of larger northern Mexican gartersnakes at sites where bullfrogs were present, and suggested that bullfrogs had probably consumed most of the juvenile gartersnakes. They also concluded that squeeze-type wounds or shortened, club-like tails were evidence of predation attempts on adult snakes by bullfrogs. They hypothesized that these injuries could reduce fitness or result in death. Rosen and Schwalbe (1988) observed that bullfrogs replace native leopard frogs through competition and predation, thus depleting native prey availability for the snakes. Bullfrogs are also known carriers of the emerging pathogenic fungus, *Batrachochytrium dendrobatidis*, which has been implicated in the global decline of amphibians and the extinction of numerous species (Garner et al. 2006). By spreading disease to native leopard frogs, bullfrogs may indirectly affect the gartersnakes' prey base.

Crayfish prey on small aquatic vertebrates (Fernandez and Rosen 1996, Schwendiman 2001) and also likely negatively impact northern Mexican gartersnakes. Crayfish remove aquatic vegetation (Saiki and Zeibell 1976, Fernandez and Rosen 1996), which could directly affect gartersnake prey species and their habitat. If given the opportunity, crayfish prey on, or at least attempt to prey on gartersnakes, especially neonates (Fernandez and Rosen 1996).

### Northern Leopard Frog

Interaction species: Rainbow trout, brook trout, cutthroat trout, brown trout, Apache trout, channel catfish, Arctic grayling, largemouth bass, bluegill sunfish, redear sunfish, yellow perch, walleye, black crappie, threadfin shad.

For interactions of northern leopard frogs with stocked fish, see the section above on Chiricahua

leopard frogs since the interactions between stocked species and northern leopard frogs would be the same.

### Sonora Tiger Salamander

Interaction species: Largemouth bass, bluegill, redear sunfish, channel catfish, rainbow trout

Sonora tiger salamanders are restricted to stock tanks in the San Rafael Valley and adjacent foothills of the Patagonia and Huachuca mountains, and have been reported from one natural habitat (Los Fresnos cienega, Sonora, México). Populations are largely composed of mature branchiate individuals (for definitions of life history stages, see Collins 1981), although mature metamorphosed animals persist in the surrounding terrestrial environments and return to the tanks to breed from January to May (Collins et al. 1988, Jones et al. 1988). Mature branchiate Sonora tiger salamanders require permanent standing water to complete their life cycle, and there is no evidence to suggest that any Sonora tiger salamanders ever complete their life cycles in ephemeral waters (Collins et al. 1988).

The degree to which tiger salamanders would enter permanent water containing predatory fishes is not known. Although one might expect strong selection against those individuals that exhibit such behavior, data to test that assumption are few. Experiments with spotted salamanders (*Ambystoma maculatum*), an ecologically similar salamander, indicate that breeding spotted salamanders do not avoid ponds with predatory fishes (Sexton et al. 1994) despite the fact that those that failed to detect fish and bred in those ponds never produced metamorphosed young (Ireland 1989). Collins et al. (1988) provided data to suggest that Sonora tiger salamanders recolonized stock tanks that had recently supported fishes, indicating that the salamanders might not discriminate among breeding sites.

There are few data to evaluate the extent to which metamorphosed Sonora tiger salamanders move away from breeding ponds. But, marked Sonora tiger salamanders have been found 1.5 and 2 km (0.9 and 1.2 mi) from tanks where they had been found the previous spring, and others have been found 3–4 km (1.9 – 2.5 mi) from the nearest potential source population (Maret et al. 2006). The sites nearest to Parker Canyon Lake that have been known to support Sonora tiger salamanders and their straight-line distances from the lake include: Hannah Tank (1.7 km [1.1 mi]), Heidi Tank (2.8 km [1.75 mi]), High Berm Tank (2.7 km [1.7 mi]), Dinner Tank (3.4 km [2.1 mi]) and Bill Woods Tank (4.2 km [2.6 mi]), all of which are presumably close enough for salamanders to disperse to Parker Canyon Lake. Consequently, it is possible that Sonora tiger salamanders could enter Parker Canyon Lake, but we do not know how likely that would be.

### Competition

Populations of tiger salamanders are unlikely to persist along with fishes. But, if salamanders and fishes did coexist, there might be limited use of similar resources. For example, like other tiger salamanders both mature metamorphosed or branchiate Sonora tiger salamanders feed on aquatic macro-invertebrates (T. Jones, pers. comm.); larvae feed primarily on zooplankton (USFWS 2002c). Nonetheless, for competition to occur, there must be a limited shared resource, and evidence for resource limitation has not been demonstrated at Parker Canyon Lake, and stock tanks are generally highly productive and aquatic invertebrates are abundant (T. Jones pers.

comm.). Also, permanent waters around Parker Canyon Lake are generally not connected to the lake, and stocked fish cannot move to those sites on their own to come into contact with salamanders in the tanks (largemouth bass and bluegill have been found in salamander habitats away from the lake [AGFD Sonoran tiger salamander database], likely the result of illegal movement of fish). Therefore, competition between Sonora tiger salamanders and stocked fish species is possible, but not likely.

### Predation

Collins et al. (1988) concluded that Sonora tiger salamanders were invariably eliminated by predatory exotic fishes, especially centrarchids and ictalurids, and predation by fish has been identified as a primary threat to the salamanders' continued existence (USFWS 2002c). Maret et al. (2006) found that risk of local extirpation of salamander populations was increased by introduced fish, and if fish eliminated salamanders, the salamanders would not recolonize sites successfully unless fish had been eliminated. Adult metamorphosed Sonora tiger salamanders do not return to the water except to breed from January through May. At that time they are at risk of predation if they enter habitats like Parker Canyon Lake containing large predatory fishes. Any eggs or larvae produced in Parker Canyon Lake would be at similar or higher risk.

The degree to which tiger salamanders would enter permanent water containing predatory fishes is not known. Although one might expect strong selection against those individuals that exhibit such behavior, data to test that assumption are few. Experiments with spotted salamanders (*Ambystoma maculatum*), an ecologically similar salamander, indicate that breeding spotted salamanders do not avoid ponds with predatory fishes (Sexton et al. 1994), and those that failed to detect fish and bred in those ponds never produced metamorphosed young (Ireland 1989). Collins et al. (1988) provided data to suggest that Sonora tiger salamanders recolonized stock tanks that had recently supported fishes, indicating that the salamanders might not discriminate among breeding sites.

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### Baitfish/Live bait issues

Use of live baitfish or tiger salamanders is prohibited at Parker Canyon Lake and throughout the range of Sonora tiger salamanders. As indicated above, Sonora tiger salamanders at all life history stages are subject to predation by predatory fishes and might be at risk of illegal baitfish introduction (USFWS 2002c). Bait fishes, including centrarchids, mosquitofish, etc., would likely feed upon salamander eggs and early larval stages (e.g., Baber and Babbitt 2003) and

eventually eliminate salamanders. For example, at FS799 Tank salamanders were documented in 1984; the tank was revisited in 1994 and only mosquitofish and bullfrogs were found. No salamanders have been documented there since then, despite at least 15 sampling visits from 1994 – 2008.

Crayfish and bullfrogs are permitted to be used as bait only in the body of water from which they are taken, but in some cases are probably moved among bodies of water despite restrictions, and therefore might be introduced into these systems by anglers. The introduction of nonnative fish, crayfish, and bullfrogs has had negative effects on native aquatic herpetofauna populations in Arizona. Bullfrogs have been implicated in the decline of native ranid frogs and northern Mexican gartersnakes in Arizona (Rosen and Schwalbe 1988, M. Sredl pers. comm., V. Boyarski pers. comm.). Rosen and Schwalbe (1988) observed that bullfrogs replace native leopard frogs through competition and predation; they prey directly on and deplete native prey availability for northern Mexican gartersnakes. Bullfrogs prey on Sonora tiger salamanders (Maret et al. 2006, T. Jones pers. comm.). Bullfrogs are also known carriers of the emerging pathogenic fungus, *Batrachochytrium dendrobatidis*, which has been implicated in the global decline of amphibians and the extinction of numerous species (Garner et al. 2006). By spreading Bd to Sonora tiger salamanders which can harbor the disease organisms probably for long periods of time (Davidson et al. 2003), bullfrogs might also indirectly affect Chiricahua leopard frog populations within the range of the salamanders.

Crayfish prey on small aquatic vertebrates (Fernandez and Rosen 1996, Schwendiman 2001) and also likely prey on salamanders, including their eggs and larvae. Crayfish are not found frequently within the distribution of Sonora tiger salamanders, but where they have been found they were abundant and salamanders did not co-occur (e.g., Rosemary Tank in 1982; T. Jones pers. comm.). It is highly unlikely that salamanders could persist in the presence of crayfish.

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## Appendix E

### Supporting Information for Concurrences

#### Arizona treefrog-Huachuca/Canelo Distinct Population Segment (DPS)

##### *Proposed action*

The proposed action is the stocking of rainbow trout, bluegill, redear sunfish, and channel catfish into Parker Canyon Lake. Rainbow trout stockings would occur every year while warmwater stockings would occur only to augment the fishery or after catastrophic events.

To address the potential for adverse effects to the Arizona treefrog Huachuca DPS, AGFD has included the following conservation measures in the proposed action:

AGFD will conduct a statewide live bait (bait fish and tiger salamanders) regulation assessment and risk analysis to develop recommendations to amend live bait regulations. These recommendations will be presented to the AGFC for implementation consideration.

AGFD will review the existing angler information concerning the restrictions on transport and use of tiger salamanders at Parker Canyon Lake and modify the information as deemed appropriate to increase angler awareness that such transport and use are illegal.

##### *Listing status*

The Arizona treefrog DPS became a candidate on December 6, 2007. The area covered by the DPS includes lands on the Coronado National Forest and Fort Huachuca in Arizona and Rancho Los Fresnos in Sonora, Mexico. That land is owned by Naturalia, a non-governmental environmental protection organization. The DPS population is disjunct from other Arizona treefrog populations and has a limited amount of breeding habitat; less than 10 acres in Arizona and less than 20 acres in Sonora (USFWS 2010a).

##### *Background*

Arizona treefrogs are active from late June to early October and use mesic habitats such as shaded oak groves, wet seeps, and other moist locations during the day (Holm and Lowe 1995) and only converge on breeding ponds at night. This use of refuge sites away from breeding ponds may reduce the risk of predation by aquatic predators. Breeding takes place primarily in ephemeral waters. Although they sometimes use permanent sites, such as stock tanks, they are less likely to support treefrog larvae because of the increased presence of aquatic invertebrate and vertebrate predators, including predatory insects, and nonnative crayfish, bullfrogs or fish species (Collins 1996). Arizona treefrogs are not generally found in permanent waters containing nonnative aquatic predators and permanent waters are seldom used for breeding (USFWS 2010a). There are 13-16 known localities in Arizona, with only eight documented to have Arizona treefrogs present in the last decade, and observed breeding populations range in

size between two and 30 individuals. In Rancho Los Fresnos, there are two sites with another nearby (USFWS 2010). Population sizes of Arizona treefrogs outside of the DPS tend to be larger and more robust.

Loss or degradation of habitat due to catastrophic fire, drought, floods, improper livestock grazing, contaminants, and off-highway vehicles is a major threat to the Arizona treefrog. The 2011 Monument Fire likely affected Arizona treefrog populations in Brown and Carr canyons (Douglas 2011). Predation by introduced species is also significant, and both types of threats are exacerbated by the small population size and limited habitat area. No Arizona treefrogs in the Huachuca-Canelo Hills region have been tested for chytridiomycosis. Frogs of this species have occasionally tested positive for the disease in the Mogollon Rim region of Arizona; however, no die offs of frogs have been noted in those populations and the species generally appears to avoid infections in nature (Sredl and Caldwell 2003, Miera et al. 2005).

### *Effects analysis*

#### Direct effects

There are no movement data for Arizona treefrogs, so the extent to which they are likely to move to sites with stocked fish is unknown. Studies of other, ecologically similar and similarly-sized species of hylid frogs provide a conservative basis for comparison. Maximum movement distances have been reported for pine barrens treefrogs (102 m), gray treefrogs (about 300 m), and western chorus frogs (about 200 m) (Freda and Gonzalez 1986, Johnson et al. 2007, Kramer 1973), all of which breed in ephemeral waters and spend most of the non-breeding season feeding in adjacent forests. Importantly, all of those species occur in more mesic habitats in the eastern U.S., which would facilitate terrestrial movements. Thus, we conservatively suggest that Arizona treefrogs might move up to 300 m from breeding sites.

The distribution of Arizona treefrogs in and around the Huachuca Mountains is incompletely understood (USFWS 2010a). The nearest known breeding sites include Hannah Tank (1.7 km [1.05 mi] E of Parker Canyon Lake) and Whiner Tank (2.9 km [1.8 mi] N of Parker Canyon Lake); other nearby sites include those in Scotia Canyon northeast of the lake > 3 km (> 1.9 mi) (USFWS 2010a). Although these known sites are farther than 300 m from Parker Canyon Lake, we do not know if there are populations of Arizona treefrogs closer to the lake. Thus, it is possible that Arizona treefrogs could enter Parker Canyon Lake. The likelihood of this happening is unknown; however, the number of breeding sites within 300 m is likely very small.

Any dispersing Arizona treefrog that moves into a stocking site is at risk of predation by largemouth bass, channel catfish, and rainbow trout. Hovey and Ervin (2005) reported juvenile largemouth bass predation on a California treefrog (*Pseudacris cadaverina*), a species about the same size as the Arizona treefrog. Matthews et al. (2001) documented a strong negative correlation between the distribution of Pacific treefrogs (*Pseudacris regilla*, ecologically similar to Arizona treefrogs) and introduced nonnative trout species (*Onchorhynchus* spp.), and suggested that predation was the probable cause. Pacific treefrogs are typically only found in waters lacking fish. Salmonids, goldfish (*Carassius auratus*), and sunfish (Centrarchidae) have all been implicated in extirpations or near extirpations of Pacific treefrogs (see review in

Rorabaugh and Lannoo 2005).

#### Illegal and inadvertent transport effects

Illegal use of live bait and illegal transport of sport fish from one site to another cannot be ignored. Presence of sport fish encourages anglers to use live bait illegally and creates an opportunity to illegally move sport fish from one site to another that would not exist but for the legal stocking of sport fish. As already mentioned, most of the fish species in Parker Canyon Lake have been established there through illegal stockings. Illegal movement of stocked channel catfish from Parker Canyon Lake may occur. While present, predation on all life stages of Arizona treefrog is possible by channel catfish (stocked) or largemouth bass (illegally stocked). However, the ephemeral waters typically used by Arizona treefrogs for breeding could not maintain populations of these species.

Use of live baitfish and waterdogs (tiger salamanders) at Parker Canyon Lake is prohibited under Arizona Game and Fish Commission Order 40 and Rule 12-4-316(C). Crayfish captured at the lake may be used for fishing at the lake, but cannot be transported to or from the lake while alive (R12-4-316(D)). In a survey of anglers that use tiger salamanders as bait, 67% of them claimed to release bait salamanders into the bodies of water they fished, even though such release is strictly prohibited by AGFD fishing regulations (Picco and Collins 2008). However, there is a continuing concern for the use and release of waterdogs at the lake and in the tanks surrounding the lake due to their ability to hybridize with the endangered Sonoran tiger salamander. Baitfish species are unlikely to persist in the ephemeral habitats used by Arizona treefrog, and exposure to baitfish would be limited to permanent waters where Arizona treefrogs are not likely to occur. Waterdogs are the branchiate form of the tiger salamander and are known to prey on treefrogs in other parts of Arizona (Sredl and Collins 1992). Illegally released waterdogs may be able to use the ephemeral habitats of the Arizona treefrog, and, if they metamorphose to terrestrial adults, may be a threat in the moist habitats used by adult Arizona treefrogs. Nonnative tiger salamanders were not identified as a significant predator of Arizona treefrogs in the DPS in the annual species status assessment (USFWS 2010a).

Use of waterdogs is not allowed at Parker Canyon Lake under AGFD orders and rules; however, there is documentation of violations of those rules through the continuing presence of nonnative tiger salamanders in tanks near Parker Canyon Lake. The illegal use of waterdogs by anglers pursuing largemouth bass or northern pike at the lake is a clear example of the difficulty in attributing effects of the proposed action on consultation species related to anglers. Except for channel catfish, all the warmwater sportfish in the lake were, illegally introduced (Parker Canyon Lake was originally built for a trout fishery) and AGFD has not supplementally stocked any of the illegally introduced species. The proposed action is the continued stocking of rainbow trout and channel catfish and new stockings of bluegill and redear sunfish to supplement the fishery or restore populations after a catastrophic event. No supplemental stocking of largemouth bass or northern pike is proposed.

#### *Finding*

Direct effects to Arizona treefrog from stocking sportfish into Parker Canyon Lake are very

limited. It is unlikely that any individual Arizona treefrogs would access the lake to be exposed to stocked fish species. These potential effects are insignificant.

Maintaining the fishery through the proposed action at the lake is not connected to the illegal use of waterdogs since none of the stocked species are fished for using waterdogs. The potential effect of the illegal movement of waterdogs to tanks and other waters in the vicinity of the lake is predation on all life stages of Arizona treefrog. However, tiger salamanders are not identified as a significant predation threat for the DPS. Unless and until new information provides an assessment of potential predation, these potential effects are discountable.

However, this illegal use may contribute to the spread of parasites and diseases that may have adverse effects on Arizona treefrogs, and that analysis is part of the environmental baseline and the cumulative effects. Conservation measures included in the proposed action provide additional public notice of the rule preventing waterdog use at Parker Canyon Lake will assist in reducing the “ignorance” stockings of waterdogs at the lake and surrounding tanks.

### **Colorado pikeminnow**

#### Verde River 10j population

##### *Proposed action*

The proposed action is the annual stocking of rainbow trout into the middle Verde River, Oak Creek, West Clear Creek, and Wet Beaver Creek.

##### *Listing status*

The Fish and Wildlife Service established “nonessential” experimental population areas for the pikeminnow in Arizona on July 24, 1985 (50 FR30188-30195). Two areas were designated; the Salt River from Roosevelt Dam upstream to the U.S. Highway 60 Bridge, and the Verde River from Horseshoe Dam upstream to Perkinsville.

For the purposes of section 7, under a “non-essential” experimental population the individuals in that population are considered as proposed for listing as threatened and a conference may be conducted. The conference must consider the status of all populations of the species, natural or experimental, in determining if the proposed action is likely to jeopardize the continued existence of the species. However, by definition, a “nonessential experimental population” is not essential to the continued existence of the species, so no proposed action with an adverse effect to a population so designated can lead to a jeopardy determination for the entire species.

The designation of the nonessential experimental populations of pikeminnow in Arizona contained a section 4(d) rule that allowed the State of Arizona to regulate direct taking of pikeminnow from these populations through issuance of scientific collecting permits. Further, incidental take of pikeminnow by State-licensed anglers is not a significant threat to the species, and any such taking would not be considered a violation of the Endangered Species Act if the individual pikeminnow is returned alive to the river. Where an informal conference determines

there is no likelihood of jeopardy to a proposed species, a conference report is provided and it does not contain an incidental take statement. This document serves as the conference report for the nonessential experimental populations of pikeminnow in Arizona.

### *Stocking history*

Colorado pikeminnow were stocked into the Upper Verde River (Sullivan Lake to Tapco) 22 times between 1985 and 1992 (Hendrickson 1993, Hyatt 2004) and only one individual has been recaptured in the reach (Hyatt 2004). Pikeminnow were stocked into the Upper Verde River in 1985-1988 (Hendrickson 1993) at sites near FR 638, Morgan Ranch, Perkinsville, Sycamore Creek, and near Tapco. The record of pikeminnow from near Bridgeport (Ziebell and Roy 1989 in Kubacki 1998) likely came from those stockings. Stockings into the Upper Verde River of fish over 300mm continued in 1991-1993 (Hyatt 2004). The species was extirpated from this area prior to the stocking efforts, and survival of the stocked fish has been low or non-existent. The Colorado pikeminnow is not believed to be present in the Upper Verde River.

Colorado pikeminnow were stocked into the Middle Verde River (Tapco to West Clear Creek) twice in 1985 at West Clear Creek (Table 1), but none were stocked in the Middle Verde after 1985. Surveys from Tuzigoot to Beasley Flat in June, 2003, (Clark 2003), and July, 2006, (Chmiel 2006) did not locate any pikeminnows. The Colorado pikeminnow may no longer be present in most of the Middle Verde reach.

Beginning in 1995, larger pikeminnow were stocked outside of the Middle Verde River in the Lower Verde River reach below West Clear Creek between Beasley Flats and Childs (summarized in Hyatt 2004, Gill 2007). The pikeminnow stocking site is upstream of the confluence of the East Verde River and the Verde River. Pikeminnow are currently found downstream in the Lower Verde River near the stocking sites at Childs and Beasley Flats and in Horseshoe Reservoir (Table 2). There are also reports of anglers catching pikeminnow near Beasley Flats. Successful establishment of an adult population in this reach is difficult to assess, as the numbers of fish recaptured over time has not maintained the numbers seen in the late-1990s, and the fish that are captured are recently stocked, at large only a few months (Hyatt 2004, Robinson 2007). No recruitment has been documented.

Table 1: Stockings of Colorado pikeminnow into the Middle Verde River

| Location         | Year | Number | Average Size (millimeters) |
|------------------|------|--------|----------------------------|
| West Clear Creek | 1985 | 8,000  | 76                         |
|                  | 1985 | 5,000  | 76                         |

Table 2: Recaptures (post-stocking) of Colorado pikeminnow in the Lower Verde River since larger (300mm) fish began to be stocked in 1995

| Year | Location                | Number | Source                         |
|------|-------------------------|--------|--------------------------------|
| 1995 | Childs to Sheep Bridge  | 0      | Cited in Jahrke and Clark 1999 |
| 1996 | Childs to Sheep Bridge  | 5      | Cited in Jahrke and Clark 1999 |
| 1996 | Horseshoe Reservoir     | 22     | Cited in Jahrke and Clark 1999 |
| 1997 | Beasley Flats to Childs | 6      | Cited in Jahrke and Clark 1999 |



|      |                                          |    |                                                     |
|------|------------------------------------------|----|-----------------------------------------------------|
| 1997 | Childs to Sheep Bridge                   | 17 | Cited in Jahrke and Clark 1999                      |
| 1997 | Horseshoe Reservoir                      | 0  | Cited in Jahrke and Clark 1999                      |
| 1998 | Beasley Flats to Childs                  | 2  | Cited in Jahrke and Clark 1999                      |
| 1998 | Childs to Sheep Bridge                   | 37 | Cited in Jahrke and Clark 1999                      |
| 1998 | Horseshoe Reservoir                      | 0  | Cited in Jahrke and Clark 1999                      |
| 1999 | Childs to Sheep Bridge                   | 3  | Cited in Jahrke and Clark 1999                      |
| 1999 | Horseshoe Reservoir                      | 0  | Cited in Jahrke and Clark 1999                      |
| 2000 | No captures noted                        |    | Cited in Hyatt 2004                                 |
| 2001 | Unknown, probably Childs to Sheep Bridge | 0  | Cited in Gill 2007, probably Weedman 2001           |
| 2002 | Childs to Sheep Bridge                   | 0  | Cited in Gill 2007, probably Weedman 2002           |
| 2003 | Childs to Sheep Bridge                   | 1  | Cited in Gill 2007, probably Weedman 2003           |
| 2004 | Childs to Sheep Bridge                   | 0  | Cited in Gill 2007, probably Weedman 2004           |
| 2005 | Childs to Sheep Bridge                   | 0  | Cited in Gill 2007: probably Duffy and Weedman 2005 |
| 2006 | Childs to Sheep Bridge                   | 0  | Cited in Gill 2007                                  |
| 2006 | Horseshoe Reservoir                      | 4  | Robinson 2007                                       |
| 2007 | Childs to Sheep Bridge                   | 0  | Cited in Gill 2007                                  |

### *Effects analysis*

Stocked rainbow trout from the Middle Verde stocking sites (Middle Verde River, Oak Creek, Wet Beaver Creek, and West Clear Creek) can, using normal flows, move out of their stocking reaches and access the lower Verde River occupied by Colorado pikeminnow. The number of rainbow trout moving into this area is likely low, with the most contribution probably coming from West Clear Creek. Rainbow trout stocked into the East Verde River stocking sites (East Verde River and Green Valley Lake) are, because of distance (river site) or limited spill and species movement risk (lake site) are very unlikely to reach the Verde River in the area occupied by Colorado pikeminnow.

The Colorado pikeminnow stocked into the lower Verde River are too large to be preyed upon by stocked rainbow trout, and the trout may provide a temporary forage base.

### *Finding*

While there may be a limited potential for adverse effects to individual pikeminnow in the Verde River nonessential experimental population from the proposed stocking actions, they do not rise to a level where take is reasonably likely to occur or to the level of jeopardy.

### **Desert pupfish**

#### *Listing status*

The desert pupfish (*Cyprinodon macularius*) was listed as an endangered species with critical habitat in 1986 (USFWS 1986a). The Quitobaquito, or Sonoyta, pupfish (*C. eremus*) was previously considered a subspecies of desert pupfish (*C. m. eremus*), but was recognized as a distinct species in 2000 (Echelle et al. 2000) inhabiting the Rio Sonoyta drainage in Pima County, Arizona and Sonora, Mexico. Although the Quitobaquito pupfish is listed under the ESA as the desert pupfish, the taxonomic status of the species is currently under review and it is assumed that it will in time be listed as a separate species with a similar status (endangered) as the desert pupfish. Critical habitat was designated for the desert pupfish (Quitobaquito pupfish) in Arizona at Quitobaquito Springs in Pima County and for the desert pupfish in Imperial County, California. The Desert Pupfish Recovery Plan was completed in 1993 (USFWS 1993). The 5-year review was completed in 2010 (USFWS 2010b) and contains the most updated status of the species.

The desert pupfish complex was historically comprised of two subspecies, the nominal desert pupfish (*C. m. macularius*), and the Quitobaquito pupfish (*C. m. eremus*), and an undescribed species, the Monkey Spring pupfish (*Cyprinodon* sp.) (USFWS 1993). The subspecies are now recognized as separate species, the desert pupfish (*C. macularius*), the Sonoyta (Quitobaquito) pupfish (*C. eremus*) (Echelle et al. 2000), and the undescribed Monkey Springs pupfish has since been described and renamed the Santa Cruz pupfish (*C. arcuatus*) (Minckley et al. 2002, Fishbase.org 2010a, b, c; Scharpf 2010).

The effects analysis for the Quitobaquito pupfish is in a separate document.

### *Background*

Historical distribution of the desert pupfish was the Gila River Basin below about 1,500 meters, particularly in the Gila, San Pedro, Salt, and Santa Cruz subbasins. Although there are no historical records for the northern portion of the Gila River Basin (Agua Fria, Hassayampa, and Verde Rivers), it is believed these areas also supported the species. Desert pupfish were also found along the lower Colorado River, the Salton Sink, and the Laguna Salada Basin in Mexico (summarized in USFWS 1993). Currently, no natural populations of the desert pupfish exist in Arizona. Natural populations are found around the Salton Sink in Imperial and Riverside Counties, California, and in several locations in Mexico. Loss of habitat due to water-development activities and other land-management actions; and the introduction of nonnative fish and amphibians are the primary causes for the extirpation of the desert pupfish from Arizona.

The desert pupfish historically occupied springs; cienegas; shallow pools; slow, shallow stream flows; or the margins of larger water bodies. Substrates were usually soft, with varying amounts of submerged and emergent vegetation. Desert pupfish can tolerate high salinities and high water temperatures (USFWS 1993).

Desert pupfish in Arizona are found only in reintroduction areas where populations may contribute to the conservation of the species. Approximately 16 of these conservation populations exist, with more expected to be established over the 10-year period of this consultation.

*Effects analysis*

As referenced previously, information in Appendix D of this BCO contains compiled information on the effects of nonnative stocked sportfish species to native fish species. Additional discussions on the effects of nonnative stocked sportfish species to the desert pupfish are in the recovery plan (USFWS 1993), background documents for the Central Arizona Project consultations (USFWS 2001a), and the Safe Harbor biological opinion (USFWS 2008). These documents are incorporated by reference. The following discussion of effects is only a brief examination of the potential for predation and/or competition by the stocked sportfish species on desert pupfish.

There are no direct effects to desert pupfish from the proposed action. Indirect effects could occur if desert pupfish from the conservation sites were to move out of those sites and be exposed to stocked sportfish or their progeny or if stocked sportfish or their progeny could reach the conservation sites. The conservation sites potentially affected are: the Phoenix Zoo and Desert Botanical Garden, and three sites in the Agua Fria River drainage (Larry Creek, Lousy Canyon, and Tule Creek).

*Phoenix Urban Lakes*

There are 31 man-made lakes in the Phoenix metropolitan area that are proposed for stocking with both warmwater and coldwater fish species. Of these sites, 24 are closed systems where stocked fish are unable to escape the stocking sites and access the Salt River Project canals or other connected waterways. The remaining seven sites have hydrologic connectivity to the Salt River bed during flood events, and, small fish can move out of six of the sites back into the SRP canals that provide their water source.

Desert pupfish reintroduction sites are at the Arizona Trail exhibit of the Phoenix Zoo, and at an interpretive pond within the Desert Botanical Gardens. Pupfish were established at the Phoenix Zoo in 1986, and the Desert Botanical population was established in 1987. Both populations remain extant, are isolated from existing surface waters, and have restricted public access. Both sites are further than five miles from stocking sites at Papago Ponds and Kiwanis Lake. Kiwanis Lake is a closed system and sportfish stocked there cannot leave the site. Papago Ponds are three lakes at Papago Park, adjacent to the Phoenix Zoo and Botanical Garden. These ponds contribute water to the series of ponds at the Phoenix Zoo. However, these ponds are not hydrologically connected to the desert pupfish pond at the Zoo or the Botanical Garden.

No potential impacts are anticipated on the desert pupfish due to the lack of exposure of these isolated populations from surface waters.

*Fain Lake and Lynx Lake*

Warmwater sportfish proposed for stocking into Fain and Lynx lakes, particularly channel catfish and largemouth bass, are likely predators on desert pupfish. Stocked sportfish from Fain and Lynx Lake may be transported downstream in the Agua Fria River toward the confluences

with Larry Creek, Lousy Canyon, and Tule Creek. Lynx Lake spilled during the spring runoff in 1999, 2005, 2007, and 2009. High flows were documented at downstream USGS gages during the spring in 2005 and 2009. The distance from the confluence of Lynx Creek and the Agua Fria River to the confluences with Larry Creek and Lousy Canyon is well over 30 miles, and it is an additional 15 or more miles to the confluence with Tule Creek at the uppermost end of Lake Pleasant. Flood flows from the headwaters of the Agua Fria River may also correspond with high flows in one or more of the reintroduction sites that could displace desert pupfish below the extant barriers on the three conservation streams.

Desert pupfish stocked into Larry Creek and Lousy Canyon was considered likely to disperse downstream to the confluence with the Agua Fria River (USFWS 1998a). The presence of nonnative species (mosquitofish and green sunfish) at the confluence was noted in the biological opinion for the reintroduction, and the Agua Fria River was considered not to be suitable habitat for desert pupfish, and any desert pupfish that reached there would be lost to nonnative fishes or other physical conditions in the river.

The 1998 biological opinion for Larry Creek and Lousy Canyon (there is no such consultation for Tule Creek) did not discuss the potential for stocked sportfish to be in the Agua Fria River at the confluences (USFWS 1998a). At the time of the 1998 biological opinion, Lynx Lake was already stocked with all the sportfish species included in the proposed action except largemouth bass and white crappie, and largemouth bass were already present likely due to illegal stocking. At the same time, Fain Lake was already being stocked with rainbow trout and channel catfish. Since Lynx Lake drains into Fain Lake, stocked species from Lynx Lake can access Fain Lake. Largemouth bass and bluegill are two species that had not been stocked into Fain that may have come from Lynx prior to 1999. Aside from mosquitofish and green sunfish, no other nonnative fish species were specifically mentioned in the 1999 biological opinion; however, other species were known to occur in the river as residents or transitory individuals and the stocked warmwater species may be considered among them. In addition, the presence of stocked warmwater species, including white crappie, in Lake Pleasant was also known and likely was a contributing factor to the mainstem Agua Fria River not deemed suitable habitat for desert pupfish in 1999.

In summary, there is a very low potential for desert pupfish to be exposed to stocked sportfish from Fain and Lynx lakes due to the infrequency of spills that could convey stocked sportfish or their progeny to the confluences with streams containing conservation sites, and that such flow events may not equally transport desert pupfish from the conservation sites to the confluences at the same time to allow for exposure to occur. Due to barriers on all three conservation sites, stocked sportfish or their progeny are not able to access the conservation sites from the Agua Fria River. Further, the desert pupfish that leave the conservation sites are presumed to be lost once they access the Agua Fria River due to lack of habitat and the presence of other nonnative species. The loss of these individuals does not compromise the overall health and survival of the reintroduction populations.

#### Illegal and inadvertent transport effects

The act of stocking fish obtained from AGFD hatcheries or other sources has the potential to

introduce unwanted aquatic organisms to the receiving water (see discussion in Area-Wide analysis). The use of hatchery and operational protocols for the movement of stocked species is designed to reduce the opportunity for the transmission of other nonnative fish species, parasites, or diseases via stocking actions. AGFD describes those protocols in the BA, and that information is incorporated here by reference.

As described in the Area-Wide Analyses of the BCO, illegal or inadvertent movement of unwanted aquatic organisms between waters in Arizona is in part related to the proposed action, and in part related to past actions in the action area that established these nonnative species and is part of the environmental baseline. Contamination of restored desert pupfish habitats by illegal or inadvertent movement of unwanted aquatic organisms is a potential risk since there is some degree of access to these sites.

### *Finding*

Direct effects to desert pupfish from stocking sportfish into the Phoenix urban fishing sites or Fain or Lynx Lake are unlikely to occur. Indirect effects of stocked sportfish reaching conservation stocking sites or desert pupfish moving out of those sites is also unlikely.

However, stocking actions or illegal or inadvertent transport of unwanted aquatic organisms may contribute to the introduction or spread of parasites and diseases that may have adverse effects on desert pupfish in the future. These effects are considered in the area-wide analysis as part of the environmental baseline and the cumulative effects.

## **Mexican Spotted Owl and designated critical habitat**

### *Listing status*

The Mexican spotted owl (spotted owl) was listed as a threatened species in 1993 with critical habitat designated in 2004 (USFWS 2004). The Mexican Spotted Owl Recovery Plan (USFWS 1995a) was signed in 1995. Information on the life history and habitat needs of spotted owl are discussed in the Recovery Plan.

### Determination of Exposure Potential

A total of 32 proposed sportfish stocking locations are in proximity to spotted owl habitat (Table 3) and all are in designated critical habitat. The presence of anglers drawn by the fishing opportunities provided by the stockings may result in two types of potential effects: noise/human presence that may result in disturbance of spotted owl and physical effects to habitat components that may result from anglers creating or using trails or paths to access the fishing opportunity. All the identified stocking sites have been stocked in the past and do not represent new areas of potential disturbance. To determine where such disturbance and/or habitat effects may occur, maps containing the stocking sites were overlain by maps showing where spotted owl habitat exists.

Table 3: Sportfish stocking sites with potential effects to Mexican spotted owls. Numbers

indicate the number of PACs considered in the evaluation.

| <b>Watershed</b>      | <b>Stocking site</b>  | <b>Within PAC</b> | <b>Within buffer</b> | <b>Within CH</b> |
|-----------------------|-----------------------|-------------------|----------------------|------------------|
| Havasas Creek         | Dogtown Reservoir     | n                 | n                    | y                |
| Little Colorado River | Hulsey Lake           | n                 | n                    | y                |
|                       | Mexican Hay Lake      | n                 | n                    | y                |
|                       | Carnero Lake          | n                 | n                    | y                |
|                       | Bunch Reservoir       | n                 | n                    | y                |
|                       | River Reservoir       | n                 | n                    | y                |
|                       | Tunnel Reservoir      | n                 | n                    | y                |
|                       | LCR Greer             | 1                 | 1                    | y                |
|                       | LCR Sheeps Crossing   | n                 | n                    | y                |
|                       | Chevelon Canyon Lake  | n                 | 1                    | y                |
|                       | Black Canyon Lake     | n                 | 3                    | y                |
|                       | C.C. Cragin Reservoir | n                 | 4                    | y                |
|                       | Knoll Lake            | 2                 | 2                    | y                |
| Gila River            | Luna Lake             | n                 | n                    | y                |
| Wilcox Playa          | Riggs Flat Lake       | 1                 | 1                    | y                |
| Salt River            | Workman Creek         | 1                 | 1                    | y                |
|                       | Canyon Creek          | 3                 | 4                    | y                |
|                       | Ackre Lake            | n                 | n                    | y                |
|                       | East Fork Black River | n                 | 1                    | y                |
|                       | West Fork Black River | n                 | n                    | y                |
|                       | Christopher Creek     | n                 | 1                    | y                |
|                       | Haigler Creek         | n                 | n                    | y                |
| Santa Cruz River      | Pena Blanca Lake      | n                 | n                    | y                |
|                       | Rose Canyon Lake      | n                 | 1                    | y                |
| Verde River           | Elk Tank              | n                 | n                    | y                |
|                       | JD Dam Lake           | n                 | n                    | y                |
|                       | Middle Tank           | n                 | n                    | y                |
|                       | Perkins Tank          | n                 | n                    | y                |
|                       | Oak Creek             | n                 | 1                    | y                |
|                       | Goldwater Lake        | n                 | n                    | y                |
|                       | Huffer Tank           | n                 | n                    | y                |
|                       | Dude Creek            | n                 | n                    | y                |

For management purposes, spotted owl habitat is categorized as protected or restricted (USFWS 1995a), with designated critical habitat overlain on those categories. Protected habitats include the Protected Activity Centers (PACs) which contain known nesting and roosting habitats and are mapped in GIS layers. The PACs are an area of approximately 600 acres and are where activities during the breeding season (March 1 through August 31) are concentrated. All PACs are considered to be occupied by spotted owl. The PAC is not the entire home ranges of an owl pair; home ranges are larger and contain additional areas used by spotted owl both during and outside of the breeding season.

Other protected habitat areas include steep-slope mixed conifer and pine-oak forests outside of PACs (USFWS 1995a). Restricted areas, as described in the Recovery Plan (USFWS 1995) are areas outside of PACs where additional guidelines should be implemented to maintain or develop potential nesting and roosting habitat now and into the future. Neither other protected areas nor restricted areas are included on GIS layers available for this analysis. However, most of these identified areas are included within the boundaries of designated critical habitat (CH), which is an available map layer and was used in determining exposure potential. The map layer does not provide guidance on whether or not a particular parcel of land within the boundaries actually contains the primary constituent elements (PBFs) of critical habitat and key habitat components (KHCs) of identified spotted owl habitat. In this analysis, we assume those are present unless we have information to indicate otherwise. To be clear though, only habitat within the critical habitat boundary that meets the definition of protected or restricted habitat is considered to be critical habitat (USFWS 2004).

For the purposes of this analysis, the CH boundaries are considered to include protected or restricted habitats that might be affected by anglers accessing fishing opportunities resulting from stocking. There is use by spotted owl of forested areas outside of PAC boundaries and outside of critical habitat; however, the intent of the PAC and restricted area management guidelines is to protect the areas most likely used by the spotted owl from significant effects from land management activities. While assuming that CH contains this entire habitat around the stocking site, there may be a small amount of habitat area not in CH that would be excluded from this analysis. The amount of such habitat is likely to be very minimal and not significant to the outcome of this analysis.

Based on existing data, limiting potentially disturbing activities to areas greater than 0.25 mile from spotted owl nest sites during the breeding season (March 1 through August 31) is beneficial to spotted owl. This corresponds well with the Delaney et al.'s (1999) 0.25 mile threshold for alert responses to helicopter flights. The additional 0.25 mi buffer provides a conservative approach in that it extends the potential use area to account for spotted owls use along the edge of the PAC and nearby protected or restricted areas during the breeding season. The potential area for angler disturbance was also extended along the stream above or below the stocking site if fish could move from the site and angler access was available (called herein the fishing opportunity area). This extension was evaluated on a site-by-site basis. If the fishing opportunity area or identified access to it was within the 0.25 mile buffer area or the PAC itself, the potential for disturbance effects during the breeding season was deemed possible. If the fishing opportunity area or identified access to it was outside the 0.25 mi buffer or the PAC itself, disturbance effects during the breeding season were deemed unlikely. If the fishing opportunity area or identified access to it was inside CH or in a PAC or buffer area, habitat effects were deemed possible.

Anglers may access PACs, buffer areas, or CH by moving through the area to reach a fishing opportunity area or the fishing opportunity area may be in the PAC, buffer, or CH unit. It must be noted that stocking sites are often in conjunction with other developed recreational sites that include developed campgrounds, roads, parking areas, or other amenities present that may affect spotted owl use of the area. Anglers are only one component of the recreational use of the PACs,

buffers, and CH surrounding stocking sites.

### *Effects Discussion: Disturbance*

The PAC, and the area immediately around it, is where most spotted owl activity during the breeding season is likely to occur. Human disturbance during the breeding season is the important disturbance effect for this analysis. PACs are delineated to include the best spotted owl habitats for nesting and roosting, but that does not mean that habitats immediately adjacent to the boundary are not suitable for owl activities during the breeding season, including nesting, roosting, and foraging. While it is likely that most activities associated with the breeding season occur within the PAC for a given owl pair, it is also likely that the further from the PAC boundary the less likely spotted owls are to be found there during the breeding season. There may be human disturbance to spotted owl outside of this area or this season and this is acknowledged to occur, however, angler use during the stocking season in the vicinity of the PACs is concentrated during the breeding season for spotted owl and is most relevant. We acknowledge that spotted owl may be disturbed at areas outside of PACs or CH during the non-breeding season and that a small portion of that disturbance may be due to anglers accessing fishing opportunities provided by the stocking, but this potential disturbance is a very minor component and is not specifically addressed in this analysis. Generally, activities conducted outside the breeding season are considered to result in insignificant and discountable effects to spotted owl (USFWS 1995a).

Human presence and noise created by recreationists including anglers accessing a stocking site or extended area by passing through or adjacent to a PAC can affect individual spotted owls. Direct effects may occur when these activities impact individual birds at nests and roosts. Indirect effects may occur when human-caused disturbance stimuli act as a form of predation risk (Frid and Dill 2002).

There are a growing number of studies attempting to describe and quantify the impacts of non-lethal disturbance on the behavior and reproduction of wildlife, and spotted owl in particular. The potential effects of aircraft noise have received the most attention. Delaney et al. (1997) reviewed literature on the response of owls and other birds to helicopter noise and reported the following: 1) raptors in general are more susceptible to disturbance-caused nest abandonment early in the nesting season; 2) ground-based disturbances have a greater effect on reproductive rates; and 3) the tendency to flush from a nest declines with experience or habituation to the noise, although the startle response cannot be completely eliminated by habituation. Delaney et al. (1999) found that ground-based disturbances (noise from chain saws) elicited a greater flush response than aerial disturbances.

Swarthout and Steidl (2001) found that spotted owls in canyon habitats modified their behavior (e.g., increased perch height) and/or flushed in response to recreationists (hikers) based on observations during the early morning, midday, and evening. Based on their results, they recommended placing buffer zones (conservative buffer = 180 ft; less conservative buffer = 40 ft.) around known roosting sites to minimize impacts. Further, Swarthout and Steidl (2003) noted that female spotted owls decreased the amount of time they handled prey by 57% and decreased the amount of time they performed daytime maintenance activities by 30% while



hikers were present. In addition, hikers caused both female and male owls to increase the frequency of contact vocalizations. Spotted owls perched higher above the ground were less likely to flush than those on lower perches; however, at higher perches spotted owl flushed when hikers were further away likely because the owls could see the approaching hiker from a greater distance. Because this work was done in canyon habitats, perch height may or may not provide the same visual cues on flat ground or hillsides.

Spotted owls may respond to disturbance during the breeding season by abandoning their nests or young; by altering their behavior such that they are less attentive to the young, increasing the risk of the young being preyed upon or disrupting feeding patterns; or by exposing young to adverse environmental stress (Knight and Cole 1995). Spotted owls primarily forage at night with the hours around dawn and dusk particularly important (Delany et al. 1997). During the day, they perch at roost sites or are on/at the nest incubating or caring for the owlets (Gutiérrez et al. 1995). Early morning or evening hiking may overlap with the foraging period for spotted owl. There is also evidence that disturbance during years of a diminished prey base can result in lost foraging time which, in turn, may cause some raptors to leave an area or not to breed at all (Knight and Cole 1995). Topographic screening between the area of disturbance and the bird's location creates a noise buffer, and may assist in the reduction of noise disturbance (Knight and Cole 1995).

In addition, Delaney et al. (1999) found that spotted owls did not flee from helicopters when caring for young at the nest, but fled readily during the post-fledgling period. This may be a result of optimal fleeing decisions that balance the cost-benefit of fleeing. Frid and Dill (2002) hypothesize that this may be explained using predator risk-disturbance theory and perhaps the cost of an adult spotted owl fleeing during the nestling period may be higher than during the post-fledgling period.

Research on all subspecies of the spotted owl indicate that it exhibits docile behavior when approached by researchers, and there is no clear evidence of significant impact by research activity except for a negative effect on reproduction from back-pack radio transmitters (Gutierrez et al. 1995). However, researchers usually minimize disturbance to the extent possible, which may not be the case for recreational trail users. In the long-term, some species may become less responsive to human disturbance if they are not deliberately harassed; others may become very stress-prone towards humans (Bowles 1995). Excessive interaction with humans may cause a lowering of call response rates or habituation; the effects of habituation on spotted owls are unknown (Gutierrez et al. 1995). Habituation, though it may occur to some extent, often is partial or negligible (Frid and Dill 2002) and is not fully understood.

#### *Effects Discussion: Habitat*

For habitat effects, the potential changes to KHCs of protected and restricted habitats and the PBFs of CH potentially resulting from angler access to fishing opportunities is the important effect for this analysis.

The PBFs of designated critical habitat for the spotted owl were described in detail in the final rule (USFWS 2004). Three categories of PBFs were developed: 1) elements related for forest

structure; 2) elements related to maintenance of adequate prey species; and 3) elements related to canyon habitats. Important components are the presence of a variety of conifer and hardwood tree species in the community and the physical structure of the community (canopy closure, tree diameter, snags, fallen trees and other woody debris, other shrub/herbaceous plants) that will vary between particular critical habitat units based on location. The KHCs for restricted and protected spotted owl habitat, as described in the Recovery Plan (USFWS 1995a) consist of similar habitat components (e.g., large trees, large logs and snags, high canopy closure) and there is little to no distinction that needs to be made between them for the analysis.

The final rule designating critical habitat and the Recovery Plan discussed the types of Federal activities that would require section 7 consultations if critical or other spotted owl habitat would be affected. Recreational development was listed as one of those activities. In the designation of critical habitat (USFWS 2004) most recreational activities, including angling, were not identified as requiring restrictions to protect the PBF's of critical habitat from destruction or adverse modification. In making that statement, recreational activities, including angling, were assumed to not contribute to significant habitat-affecting activities such as cutting large trees or snags, removal of large woody debris from the forest floor, altering the tree species diversity, or other large-scale changes to habitat structure.

Recreational activities, including angler access to fishing opportunities, can have localized indirect effects to habitat if habitat parameters related to the PBFs/KHCs are altered by trampling of vegetation, soil compaction, removal of woody debris or other physical degradation potentially altering the productivity of the site for maintaining the prey base and succession/regeneration of the vegetation community along paths and trails or other areas with recreation use. Increased fire risk from inappropriate disposal of smoking materials or campfires at recreation sites is also a concern due to increases in wildfire risk.

### *Effects Analysis*

The effects of angler-related disturbance to individual spotted owl depends on location of the access relative to important owl habitat (intensity), the number of such encounters (frequency), and the time over which the effect occurs (duration) (USFWS 1995a). As discussed previously, location of the disturbance effect during the breeding season outside the PAC or within the PAC contributes to the potential level of the effect during the breeding season.

For effects within a PAC, those that are closest to the nest or roosting sites are more likely to result in a disturbance effect to spotted owl. As discussed above, spotted owls at nest and roosting sites alter their behavior when humans are present, with human presence within 200 feet potentially resulting in a flushing response. Spotted owls use the entire PAC during the breeding season and since the location of nest and roost sites may change over time, disturbance effects within a PAC are not distinguished by where in the PAC they occur. The more human presence at one time (intensity) likely exacerbates the disturbance effects.

Intensity of the effect can be related to the noise level resulting from human presence as well as the nearness of the humans to the spotted owl. Anglers walking to a fishing area may be speaking to other persons. Normal conversation at three to five feet away is 60-70db (GCAudio

2009), and sound attenuates with distance. At distances of over 200 feet, sound levels from normal conversation (70 db) attenuate to 25 db (Engineering Page 2009). This level of sound is comparable to whispering or rustling leaves (OMSI 2005) and may no longer be detectable over background noise.

Frequency and duration of the disturbance are also factor for both increasing the number and intensity of disturbing events and habituating spotted owl to the disturbance events. Angler-related disturbances are concentrated during the stocking season for trout species. The prime trout stocking season in areas inhabited by spotted owl is the spring and summer, which also coincides with the spotted owl breeding season (March 1- August 31), so the timing of the peak risk of disturbance is also the most sensitive period for disturbances within the PAC. However, the amount of potential disturbance to breeding spotted owls is limited to a very few sites and is likely at a very low level.

Habitat alteration outside of the PAC through creation or maintenance of access for recreationists (including anglers) is not identified as a significant issue for spotted owl survival and recovery (USFWS 1995) but may occur on a localized scale. As noted previously, this assumption is based on the limited amount of significant effects to PBFs and KHCs from recreationists, including anglers, accessing spotted owl habitats.

### *Significance*

Eight PACs are within the boundaries of five stocking sites. As discussed above, human disturbance by anglers accessing the stocking sites can disturb spotted owl at the nest or during foraging activities. The degree of effect to spotted owls in the PAC will vary by PAC and stocking area, particularly if the vegetation community that supports the PAC actually does not come up to the stocking site or the access routes of anglers. As discussed above, human disturbance by anglers accessing the stocking sites can disturb spotted owls if they are using the area within the buffer for foraging. Stocking at these sites is during the breeding season for spotted owl. During the breeding season, spotted owls forage day and night. Since anglers are not out at night, the opportunity for exposure to spotted owl is reduced. Below is discussion for PACs and buffers associated with stocking sites. All stocking sites receive significant use by anglers.

1. LCR Greer: lower 0.5 mile of stocking reach is in PAC and buffer. Very steep topography there, anglers likely stay right by stream. Most of stocking reach very open with no nesting/roosting habitat for spotted owl.
2. Knoll Lake: vegetation (mixed conifer) is pretty dense close to the shoreline. Access is from road that ends near dam, launch ramp available. Some shoreline angling, but banks can be steep and likely do not get much use away from the access area except by boats.
3. Workman Creek: trees are close to creek. Road along north side provides access to stream and campgrounds, where there are fewer trees.
4. Riggs Flat Lake: trees next to shore in some places, some shore access in areas with fewer trees, but other spots are a bit rugged. Boat access available.

5. Canyon Creek: area where stocking occurs is in open meadow/woodland. Head of creek is in dense vegetation. Most anglers fish the meadow/woodland area outside of the forested habitat.

Twenty-two 0.25 mile buffer areas are within the boundaries of 12 stocking sites. As discussed above, human disturbance by anglers accessing the stocking sites can disturb spotted owl if they are using the area within the buffer for foraging. Stocking at these sites is during the breeding season for spotted owl. Spotted owls forage during day and night during the breeding season, but since anglers are not active at night, the opportunity for exposure to spotted owls by anglers is reduced.

1. Chevelon Canyon Lake: very steep access, most use is by boat, and immediately around most of lake is open forest, mostly ponderosa pine.
2. Black Canyon Lake: area around lake was burned in the Rodeo-Chedeski Fire. Habitat is fairly open near lakeshore.
3. CC Cragin: very steep slopes on most of lake, access by boat to all parts, including upper more flat sections. Buffer areas probably come down to the lake edge and that is why they are included.
4. East Fork Black River: trees come to near stream, access points along paralleling road, campgrounds and other recreational sites also access for fishing. Heavy recreational use in vicinity of stream.
5. Christopher Creek: trees come to near stream, access for fishing along stream from campground and roads. Heavy recreational use in immediate vicinity of stream.
6. Rose Canyon Lake: shoreline is fairly open, limited vegetation, some very rocky areas. Trees limited in some shoreline areas.
7. Oak Creek: spotted owl habitat is up in Canyon, angler access to creek from parallel road, anglers do not hike far from creek.

All 32 stocking sites listed in Table 3 are within the bounds of designated critical habitat. That does not, however, mean that the PBFs for critical habitat or the KHCs for restricted and protected habitats exist at the stocking site or the access routes used by anglers. The area around the stocking site might be cleared of trees or possess vegetation characteristics not suitable for spotted owl. As discussed above, there is the potential for some habitat degradation from anglers moving in critical habitat to access the stocking site. However, this level of potential degradation was determined not likely to cause the kind of effects that would result in adverse effects to the PBFs/KHCs of spotted owl CH and/or restricted and protected habitats in the determination of critical habitat. Individual discussions for sites not mentioned in above lists were not made based on very limited potential for habitat effects.

### *Finding*

For the spotted owl, the amount of human disturbance resulting from angler access to stocking sites during the spotted owl breeding season within and/or adjacent to PACs is insignificant and discountable. In addition, the key habitat components of spotted owl habitat will not be adversely affected by the proposed action.

For spotted owl critical habitat, the amount of habitat disturbance resulting from anglers accessing the stocking sites will result in insignificant and discountable effects to PBFs.

### **Mexican wolf 10j population**

#### *Listing history*

The Mexican wolf experimental non-essential population was designated by the U.S. Fish and Wildlife Service (USFWS) in March 1997 by a 10j rulemaking (USFWS 1998b). The area covered by the designation is the Blue Range Wolf Recovery Area (BRWRA) in east central Arizona and west central New Mexico. The area includes the Alpine, Clifton, and Springerville Ranger Districts in the Apache National Forest and the Gila National Forest. In 2002 the White Mountain Apache Tribe signed an agreement with USFWS that allowed direct release and translocation on to the Fort Apache Indian Reservation. Recovery planning efforts for Mexican wolves outside of the 10j boundaries is under development by USFWS and its partners.

For section 7 purposes, under a “non-essential” experimental population, the individuals in that population are considered as proposed for listing as threatened and a conference may be conducted. The conference must consider the status of all populations of the species, natural or experimental, in determining if the proposed action is likely to jeopardize the continued existence of the species. However, by definition, a “nonessential experimental population” is not essential to the continued existence of the species, so no proposed action with an adverse effect to a population so designated can lead to a jeopardy determination for the entire species.

In the final rule for establishment of the 10j population, there are provisions for people to legally harass wolves to scare them away from people, buildings, facilities, livestock, other domestic animals, and pets as long as the incident is reported to the USFWS within seven days (USFWS 1998b).

The opportunity for increased recreational activity related to the reintroduction of wolves was addressed in the Environmental Impact Statement and evaluated in the Socioeconomic Component of the 5-year review (Unsworth et al. 2005), with potential economic benefits to be realized from managed wolf-sighting tours and other related activities. Further, in the 2010 Mexican Wolf Conservation Assessment (USFWS 2010c), except for illegal shooting, effects to wolves from people present in wolf habitat was not identified as a threat to the wolf population.

#### *Background*

Mexican wolves were first reintroduced to the BRWRA in 1998 with additional releases through 2008 (Interagency Field Team 2005, 2009). By the end of 2008, the wild population had grown to 52 animals in 10 packs (IFT 2009). In Arizona, Mexican wolf packs may use areas in the vicinity of stocking sites in the Black River, Little Colorado (Upper Little Colorado River and West Fork Little Colorado River particularly), and San Francisco River (Luna Lake) stocking sites. Packs using these areas are the Bluestem, Hawks Nest, Paradise, and Fox Mountain packs (IFT 2010a). Additionally, lone wolves, such as M619, and dispersing young wolves may move more widely out of usual use areas of the established packs (IFT 2010b).

As part of the annual operations of the IFT, project personnel make contact with campers, hunters, and other members of the public within the BRWRA and provide them with information about the Mexican wolf reintroduction project. These contacts are to provide the public with information on the potential for encountering wolves and general recommendations for recreation in wolf-occupied areas, and to collect information on wolf sightings or signs of wolves from these groups.

Human-wolf encounters may occur in three basic types; investigative search (wolves ignored humans or human activity), investigative approach (wolves moved toward humans in a non-threatening, investigative manner) and aggressive charges (wolves moved toward people rapidly) (IFT 2005). Thirty three interactions were documented between 1998 and 2003 with most (64 percent) being investigative searches, 27 percent were investigative approaches, and nine percent were aggressive charges (IFT 2005). The presence of dogs was considered a provoking factor in investigative approaches and aggressive charges. Incidences involving wolves in campgrounds made up six of the 33 events; one occurred in Big Lake Campground (Bluestem Pack). Annual reports from 2004-2007 did not report any incidences in campgrounds but there were incidences involving residences and livestock. In 2008, most reported sightings were in the vicinity of residences or corrals except for the Laredo Pack which spent part of July in proximity to a campground (IFT 2009). The 5-Year Review Technical Component (IFT 2005) contained recommendations to develop and disseminate up-to-date information on wolves to the public, including recreationists, in the recovery area to educate people on wolf behavior and how to respond when a wolf is observed. Signs and other information are posted at campgrounds and other locations to inform recreationists of wolf presence and the proper behavior to follow to avoid attracting the interest of wolves.

### *Effects analysis*

Effects to individual Mexican wolves from the proposed action are limited to indirect effects resulting from the presence of anglers in occupied Mexican wolf habitats within the BRWRA. Documented wolf-human interactions involve wolves near residences, corrals with livestock, humans herding livestock, and hunters with hanging game. The presence of dogs appears to be a factor in many of the incidences.

The documented occurrences of wolves in proximity to recreationists have been in areas such as campgrounds where there are multiple people present and there are likely food smells, dogs, and other inducements to attract the attention of wolves. One wolf was killed by a camper after it attacked their dog and another camper shot at four wolves that were approaching his dog. Two of three incidents involving the Francisco or Cienega packs at Double Cienega were more benign, with wolves coming close to humans (report did not mention dogs being present) while the third was less so due to the improper behavior of the campers (howling wolves to the camp, leaving food out, chasing wolves on ATVs) that created the situation. Except for the wolf killed in the first example, aversive conditioning was used to cause the wolves to leave the campground and none had to be translocated or removed (IFT 2005). Single humans on horseback, associated with livestock, again often with dogs, are approached, again, there being inducements in the form of dogs or livestock. Anglers at lakes are in the company of other anglers and, most

lakes in the proposed action also have campgrounds or other features that would tend to create more of an inducement to wolves to investigate. Along streams, anglers are again gathered at access locations which may or may not involve campgrounds or other recreationists being present. In addition, absent inducements, Mexican wolves avoid people.

### *Finding*

The presence of recreational anglers in the BRWRA is a subset of the total recreation component in the area. Recreationists who follow proper guidelines in wolf habitat are unlikely to be illegally harassing or harming wolves, and few documented encounters occur. Effects to wolves from anglers are insignificant and discountable.

## **Page springsnail**

### *Listing history*

Page springsnails became a candidate on February 28, 1996. A final Candidate Conservation Agreement with Assurances (CCAA) was prepared by the Arizona Game and Fish Department (AGFD) that thoroughly describes the history and occurrences for Page springsnails in the area. That agreement was finalized in October 2009 (AGFD and USFWS 2009).

### *Background*

Page springsnails are known from the Oak Creek drainage in the vicinity of the Page Springs and Bubbling Springs Pond. Their primary habitat is in Page Springs and other springs nearby, although they have been documented in ditches and other areas nearby. A small population historically occurred at Peck's Lake (Shea Spring) along the mainstem Verde River, but that population is believed to have been extirpated in the late 1970s. A previously unknown population of Page springsnails was discovered on private property in the Spring Creek area (Sheepshead Canyon), a tributary of Oak Creek in July 2007.

The Page springsnail occurs in springs, seeps, marshes, spring pools, outflows, and diverse lotic (flowing) waters, at approximately 3,510 feet (ft) (1070 meters (m)) elevation. The most common habitat is a rheocrene, or a spring emerging from the ground as a flowing stream. Habitats of hydrobiid snails are isolated, mid-elevational, permanently saturated, spring-fed aquatic climax communities commonly described as ciénegas (Hendrickson and Minckley 1984). The substrate is typically firm and consists of cobble, gravel, woody debris, and aquatic vegetation. These substrates provide a suitable surface for grazing and egg laying (Taylor 1987, Hershler 1998).

Based on our current knowledge of habitat and life history characteristics of the Page springsnail, important characteristics of its habitat appear to include: 1) permanent free-flowing springs; 2) shallow, unpolluted water; 3) coarse firm substrates such as pebble, gravel, cobble, and woody debris; 4) native aquatic macrophytes, algae, and periphyton; and 5) few or no predatory species.

### *Potential Effects*

The proposed activity is stocking rainbow trout at various points along Oak Creek, including in the vicinity of the springs. No stocking activity occurs into occupied Page springsnail habitat, and stocked fish cannot access that habitat. Page springsnails have not been documented as occurring in or along the mainstem of Oak Creek. Hatchery grounds and springheads where the springsnail occurs are closed to fishing and anglers. The CCAA identifies the springsnail as occupying spring habitat, not stream habitat where they would encounter sport fish. The CCAA does not identify sport fish as a potential threat to the species, since the springsnail occupies habitat not suitable for sport fish. Access to springsnail occupied habitat by the angling public is limited. Springsnail habitat is mostly too shallow and limited in area to support sport fish, and all these sites are isolated (no direct connection) from Oak Creek. All springsnail sites on AGFD hatcheries are fenced and closed to fishing from the public.

Exposure between the stocked rainbow trout and the springsnail is not expected to occur because of inability for them to come in contact with each other. Indirect impacts from angler activity would not occur in occupied springsnail habitat because the angling public is not allowed access to those habitats.

The concern related to the stocking program is the transmission of snails or mussels, particularly New Zealand mud snails (NZMS), via the water in stocking trucks that transport the fish from the hatchery or the establishment of such species at a hatchery via outside contamination. NZMS can displace native species and with a species of extremely limited distribution, this could result in extirpation or extinction. However, this risk is extremely small. NZMS are not present at any hatcheries within Arizona, plus management plans to control or prevent snails or mussels from occupying hatcheries are in place. Many of the hatcheries use loaders that exclude organisms and water from the raceway, except for catchable size trout. Page Springs Hatchery has two water sources, one of which is secured (Pond Springs) and the other is partially secured (Cave Spring). It is unlikely that non target organisms could become established due to the small area of exposed water coming from the Cave Spring before it enters underground pipes. Moreover, the exposed portion of the Cave Spring is protected by a chain link fence, locked gate, and screened entrance. There are also metal screens that filter debris prior to entering the headbox and subsequent hatchery pipes. Introduction of non target organisms via more natural means (transmission via mammals or birds) is unlikely due to fast moving water which largely precludes use of Cave Spring by mammals and birds. It is unlikely that NZMS would become established in these spring sources because of internal HACCP plans and hatchery procedural steps taken during day-to-day operation and maintenance, the remote locations of the springs, and also since the spring sources are not used by anglers that might transport NZMS on their wading gear. However, angler clothing or gear that is contaminated by NZMS due to pathways not associated with the proposed action (for example, fishing at sites not stocked under the proposed action where contamination could occur), still remains a threat to the Page springsnail if Oak Creek becomes contaminated by NZMS through events not connected to the stocking program.

### *Finding*



There will be no direct effect to Page springsnails from the stocking of trout in Oak Creek. The presence of HACCP and other management plans at the AGFD hatcheries intended to prevent the establishment of aquatic invasive species at the hatcheries and to reduce the risk of transporting such species during stocking operations provides several layers of defense for the Page springsnail. This level of protection, while not absolute, is sufficient to reduce the risk of adverse effects from the proposed action to insignificant and discountable levels. AGFD will continue to implement the Conservation Agreement over the next 10-years.

## **Quitobaquito pupfish and designated critical habitat**

### *Listing status*

The desert pupfish (*Cyprinodon macularius*) was listed as endangered species with critical habitat in 1986 (USFWS 1986a). The Quitobaquito, or Sonoyta, pupfish (*C. eremus*) was previously considered a subspecies of desert pupfish (*C. m. eremus*), but was recognized as a distinct species in 2000 (Echelle et al. 2000) inhabiting the Rio Sonoyta drainage in Pima County, Arizona and Sonora, Mexico. Although the Quitobaquito pupfish is listed under the ESA as the desert pupfish, the taxonomic status of the species is currently under review and it is assumed that it will in time be listed as a separate species with a similar status (endangered) as the desert pupfish. Critical habitat was designated for the desert pupfish (Quitobaquito pupfish) in Arizona at Quitobaquito Springs in Pima County. The Desert Pupfish Recovery Plan was completed in 1993 (USFWS 1993).

### *Background*

The Quitobaquito pupfish historically occupied springs, cienegas, shallow pools and slow, shallow stream flows over sandy substrates in the Rio Sonoyta basin, including Quitobaquito Springs (Miller et al. 2005). In the United States, the only natural population of Quitobaquito pupfish occurs in Quitobaquito pond, spring channel, and springs on Organ Pipe Cactus National Monument (OPCNM). Refuge populations were established at OPCNM ('La Cienega') and Cabeza Prieta National Wildlife Refuge (CPNWR) visitor centers in the winter of 2004-5. Populations in Quitobaquito Pond are currently low due to removal of pupfish during repairs to the pond. These efforts are discussed more fully later in this document. In Sonora, Mexico, the Quitobaquito pupfish is found in the Rio Sonoyta.

This is a small fish (5 cm (2 in) long) with a smoothly rounded body shape and narrow, vertical dark bars on the sides. Breeding males are blue on the tops and sides, and have yellow fins. Females and juveniles have tan to olive colored backs and silvery sides. It is found in shallow water of desert springs, small streams, and marshes below 500 m (1,500 ft) elevation. The species tolerates high salinities and high water temperatures.

Critical habitat at Quitobaquito includes "Quitobaquito Spring...and a 100-foot riparian buffer zone around the spring" (USFWS 1986a). We interpret this to mean Quitobaquito pond and a 100-foot buffer around the pond. The primary constituent elements include "clean unpolluted water that is relatively free of exotic organisms, especially exotic fishes, in small slow-moving desert streams and springs with marshy backwater areas" (USFWS 1986a).

Threats to the species at OPCNM include loss of, or damage to, the structural or physical integrity of the pond, berm, springs, or springs collecting pipe; drought; pollutants (due to its nearness to Mexico Highway 2, Quitobaquito may be subject to aerial pollutants); and the risk of contamination from a chemical spill associated with a vehicle wreck on the highway and introduction of nonnative species, particularly nonnative fish or crayfish (McMahon and Miller 1985, Hendrickson and Varela-Romero 1989, AGFD 2011). Individual nonnative fish, turtles, and tamarisk (*Tamarix ramosissima* or *chinensis*) have been documented at Quitobaquito but were subsequently removed. OPCNM biologists continually monitor Quitobaquito for nonnative species. Discharge from the Quitobaquito springs has diminished by nearly 50% over the past 30 years (AGFD 2011). Essentially no water withdrawal or livestock grazing occurs upslope and/or upstream of Quitobaquito; drought is suspected as the primary cause for this depletion.

Recent conservation efforts for the Quitobaquito pupfish have focused on repairing Quitobaquito Pond and holding pupfish in safe areas until that work is completed.

### *Effects analysis*

#### Direct effects

There are no direct effects to Quitobaquito pupfish from the proposed action. The habitat at Quitobaquito springs is not connected hydrologically to any stocking site.

#### Illegal and inadvertent transport effects

Illegal introduction of nonnative species, particularly nonnative fish or crayfish (McMahon and Miller 1985, Hendrickson and Varela 1989, AGFD 2011) is a concern for the Quitobaquito pupfish. Individual nonnative fish, turtles, and tamarisk (*Tamarix ramosissima* or *chinensis*) have been documented at Quitobaquito but were subsequently removed. For example, golden shiner was introduced into the pond in the late 1960s and required considerable effort to eliminate (Minckley 1973, Marsh and Minckley 2009). This introduction was not considered to be the result of someone establishing a baitfish population, since the nearest fishery was in the Sea of Cortez and a freshwater baitfish would not likely be used (Minckley 1973). Additionally, mosquitofish and black bullhead (*Amieurus melas*) occupy the Rio Sonoyta (Hendrickson and Varela-Romero 1989, pp. 479-480). In October 2003, a tilapia was observed in the Rio Sonoyta (Service unpublished data 2003). These nonnative fish species may prey on or compete for food or space with the Quitobaquito pupfish.

Five stocking sites (Hidden Shores Pond, Yuma West Wetlands Park, Fortuna Pond, Redondo Lake, and Wellton Golf Course Pond) are part of the proposed action closest to Quitobaquito Pond. Species to be stocked in one or more of these five sites are rainbow trout, largemouth bass, bluegill, and channel catfish. Golden shiner and goldfish are legal baitfish on waters of La Paz and Yuma counties containing the six stocking sites. Bullfrogs, waterdogs and crayfish are also legal for use as bait in those counties. Stocking of largemouth bass and/or channel catfish at the six sites provides opportunities to use legal bait. Except for rainbow trout, all the stocked sportfish and legal bait species have established populations in the Colorado and Gila rivers

adjacent to the stocking sites.

The nearest stocking site to Quitobaquito Pond is at Wellton Golf Course Pond, over 180 road miles away. There are no waters on OPCNM or the adjacent Cabeza Prieta National Wildlife Refuge that provide fishing opportunities, so the impetus to bring stocked sportfish or legal bait species from the stocking sites to Quitobaquito Pond to establish populations of these species is limited. Quitobaquito pond is currently closed to the public. Of the nonnative species stocked or legal for use as bait at stocking sites, only golden shiner has ever been reported from Quitobaquito Pond. Curtis McCasland at Cabeza Prieta National Wildlife Refuge examined tanks and waterholes used by Sonoran pronghorn in 2001 and except for catfish in one tank (Bob's Tank approximately four kilometers north of the OPCNM boundary near the town of Ajo), did not find any fish, waterdogs, or bullfrogs (McCasland 2010) in those waters.

The likelihood of angler-related illegal or inadvertent movement of unwanted aquatic species to Quitobaquito springs is extremely low but such introductions have occurred in the past. The spring and pond habitat are located far from fishing sites and are difficult to get to, reducing the likelihood of their use as a bait source for fishing. There are more accessible sites, for example Bob's Tank, where if local anglers were looking for a pond to establish a bait source or fishing opportunity, are more likely to be used for such. The monitoring of the site has not documented the introduction of any species related to sportfishing since the golden shiner in the 1960s.

The opportunity for non-angler related illegal or inadvertent movement of unwanted aquatic species to Quitobaquito is also extremely low. Water based recreation is not permitted at the springs or pond.

#### *Effects to critical habitat*

Critical habitat at Quitobaquito includes "Quitobaquito Spring...and a 100-foot riparian buffer zone around the spring" (USFWS 1986). The primary constituent elements include "clean unpolluted water that is relatively free of exotic organisms, especially exotic fishes, in small slow-moving desert streams and springs with marshy backwater areas" (USFWS 1986a). Stocking of additional exotic fishes or other non-endemic species into critical habitat was identified as a threat to critical habitat in the final rule. As this critical habitat unit is the only one of the four designated units for desert pupfish that supports the Quitobaquito pupfish, maintenance of the PCEs is essential for the conservation of this species.

Relative to the PBFs, the current condition of the Quitobaquito Spring critical habitat unit continues to be able to support the conservation of the Quitobaquito pupfish. The flows from the springs provide clean water to the aquatic habitats in the unit, and there are currently no exotic organisms, especially exotic fishes, present in the habitat. The work to repair leaks in the berm and pond to maintain water levels in Quitobaquito Pond preserves the marshy backwater component of the critical habitat unit.

Effects to critical habitat are not likely to occur due to the discussions under direct effects and illegal inadvertent transport described above.

*Finding*

Direct effects to Quitobaquito pupfish from stocking sportfish into the lower Gila and lower Colorado rivers stocking sites are unlikely to occur. The illegal or inadvertent movement of unwanted aquatic species to Quitobaquito by either anglers or other members of the public is unlikely to occur; however, because this has occurred in the past, there is a continuing risk.

However, stocking actions or illegal or inadvertent transport of unwanted aquatic organisms may contribute to the introduction or spread of parasites and diseases that may have adverse effects on Quitobaquito pupfish in the future. These effects are considered in the analysis as part of the environmental baseline and the cumulative effects.

**Sonora chub with designated critical habitat***Listing history*

The Sonora chub was listed rangewide (United States and Mexico) as a threatened species with designated critical habitat in the United States in 1986 (USFWS 1986b). A recovery plan was completed in 1992 (USFWS 1992).

Critical habitat for the Sonora chub consists of Sycamore Creek from Hank and Yank Spring downstream to the Southerly International Boundary with Mexico, the lower two kilometers of Peñasco Creek (a tributary to Sycamore Creek draining from the east), and the bottom 0.4 kilometer of an unnamed tributary to Sycamore Creek draining from the west and joining the creek upstream of the confluence with Peñasco Creek. The critical habitat contains a 25 foot wide riparian area along each side of Sycamore Creek and Peñasco Creek. There were no primary constituent elements identified for the critical habitat; however the final rule (USFWS 1986) discussed the types of activities that could modify critical habitat, implying that these were critical elements. Those activities are summarized below:

- Any activity that depletes flows or significantly alters the natural flow regime in the critical habitat reaches.
- Any activity that would extensively alter the channel morphology of the critical habitat reaches.
- Any activity that would significantly alter the water chemistry of the critical habitat reaches.
- Any activity that introduced exotic fish (and associated parasites) to the critical habitat reaches.

*Background*

Biological information on the Sonora chub is included in the final rule (USFWS 1986), the recovery plan (USFWS 1992), and most recently updated in the biological opinion for the Montana Allotment (USFWS 2001b).

At the time of listing, the Sonora chub was known in the United States in Sycamore Creek from

Yanks Springs and the lower portion of two tributaries to the creek to the Southerly International Boundary. Sycamore Creek is part of the headwaters of the Rio Altar, a tributary of the Rio Magdalena in Mexico. Sonora chub were also known from the Rio Altar and the Rio Magdalena at the time of listing. In 1995, Sonora chub were documented in the lower two miles of California Gulch, a separate tributary to the Rio Altar west of Sycamore Creek. In 2010, Sonora chub were illegally introduced into Ronquillo Tank in the Peña Blanca watershed. This is outside of the historical range of the species. While present in Ronquillo Tank, these Sonora chub may be exposed to nonnative species or diseases that may preclude their return to Sycamore Creek.

The USFWS is currently drafting the 5-year review that will contain the most recent status information for the Sonora chub. At the time of listing, the population status of the species in Mexico was considered relatively secure, and populations in Sycamore Creek were locally abundant. In California Gulch, Sonora chub populations fluctuate with the availability of water. Recent drought throughout the watershed has likely affected the populations of Sonora chub. The entry of highly turbid runoff to California Gulch from a mine site in northern Sonora was documented in November of 2009 (Douglas 2010); the effects to Sonora chub have not been assessed. No population estimates are currently available and recent survey information is lacking.

Threats to the Sonora chub include loss or degradation to habitat by mining, improper livestock grazing, and the introduction of nonnative species (fish, bullfrogs) into its habitats. A number of nonnative species, including bullfrogs, mosquitofish, goldfish, black bullhead, channel catfish, bluegill, green sunfish, and largemouth bass have been recorded from occupied Sonora chub habitats in the United States and Mexico (Douglas 2009). Green sunfish and mosquitofish were identified as present in Sycamore Canyon in the final rule (USFWS 1986b). Bullfrogs, mosquitofish, black bullheads, bluegill and green sunfish were identified in California Gulch in 1995 (USFWS 2001b) when Sonora chub were located there. Largemouth bass are also known from California Gulch. The origin of these nonnative species is unclear; however, there are private ponds in the California Gulch and Sycamore Canyon watersheds that contain nonnative species that are the likely sources of these nonnatives.

Conservation actions for the Sonora chub have focused on habitat protection, including the construction of a bridge at the Ruby Road crossing of Sycamore Creek, stabilization of the tank at Yank Spring, and livestock exclosures and managed livestock grazing along California Gulch.

The 2011 Murphy Fire burned a portion of the eastern watershed of Sycamore Creek. Post-fire runoff from the burned area may introduce ash and sediment into the occupied habitat and parts of designated critical habitat. The extent of these effects is unknown at this time.

Three formal consultations were completed for Sonora chub. The first two were for the stabilization project at Yank Spring and the construction of a bridge on Ruby Road over Sycamore Creek. The third was for Montana Allotment livestock management plan.

### *Effects analysis*

### Direct effects

The two nearest stocking sites to Sonora chub habitat are Arivaca Lake and Peña Blanca Lake. Arivaca Lake is northwest of Sycamore Creek, approximately eight miles overland and at least 15 miles away by improved and unimproved road. Sportfish proposed for stocking under the proposed action are channel catfish, bluegill and redear sunfish. Peña Blanca Lake is east of Sycamore Creek, approximately six miles overland and nine by improved road. Rainbow trout is the only sportfish proposed for stocking under the proposed action.

The Sycamore Creek drainage is hydrologically isolated from either the Arivaca Lake or Peña Blanca Lake drainages. Exposure to stocked sportfish due to hydrologically connected waters is not likely to occur.

### Illegal or inadvertent transfer

Use of live baitfish and crayfish is prohibited at both Arivaca Lake and Peña Blanca Lake. Use of waterdogs (tiger salamanders) is legal at both sites; however, the proposed action does not include any sportfish species for which waterdogs are preferred bait. Largemouth bass are currently present at Arivaca Lake, and under Commission Order 40, there is a special regulation for largemouth bass at the lake for catch-and-release fishing only (AGFD 2009). Prior to work to remediate for mercury contamination, Peña Blanca Lake supported a largemouth bass fishery. All fish in the lake were eliminated during the remediation project. The proposed action for this consultation does not include restoration of the warmwater fishery; that action is being pursued by the U.S. Forest Service-Coronado National Forest under separate section 7 consultation and effects from that re-establishment are not relevant to this proposed action.

Bluegill is the only species proposed for stocking under the proposed action that has been reported from Sonora chub habitat in California Gulch. The origin of these individuals is unknown. Information from AGFD stocking records does not indicate bluegills were ever stocked by AGFD into either Arivaca Lake or Peña Blanca Lake, but they were reported to be present in those lakes. There are tanks and private lakes in the upper portions of the Sycamore Creek and California Gulch watershed that may be the sources of these and other nonnative fish found (USFWS 2001b). When present, nonnative fish species can compete with or prey on Sonora chub; Hendrickson and Juarez-Romero (1990) noted smaller populations of Sonora chub in areas where nonnative fishes were present.

Asian tapeworm (*Bothriocephalus acheilognathi*) has been documented in fishes of the Río Yaqui watershed, including the Yaqui chub (*G. purpurea*). Yaqui chub is present only in the headwaters of the Río Yaqui, but is sympatric, or nearly so, with desert chub (*G. eremica*), the latter species currently being noted as present in the Río Sonora (Miller et al. 2005). Asian tapeworm is non-host specific, and has been found in various other *Gila* throughout the American southwest. The potential for cestode infestations in Sonora chub is a threat not previously evaluated. Illegal or inadvertent transfer of infected fish may introduce this parasite to the Sonora chub.

### Finding

While there is an opportunity for illegal or inadvertent movement of nonnative sportfish proposed for stocking from Arivaca Lake because of the proposed action to maintain those populations, the likelihood that this would occur is unknown. The distance between Arivaca Lake and Yanks Tank (at Hank and Yank Spring) is less than 20 miles and most of the road is passable by cars. The tank is an off-channel concrete structure approximately 10 feet by 20 feet and five feet deep, impounding the spring flow. Sonora chub are found in the concrete tank. Based on available information (Douglas 2009, USFWS 1986b, 1992, and 2001b) no stocked species of fish have been found in the tank or in Sycamore Creek. There is a considerable amount of recreational visitation along Sycamore Creek, with a parking lot and trailhead located at the spring area (USFWS 1992), so access to the tank for illegal or inadvertent stocking is available. Surveys of the tank are limited, so the current status is uncertain, as is the presence of any nonnative fish species.

Recreationists that access Yanks Tank may access the water, but it is unlikely that they would be transporting fish for release. Since live bait is not allowed at either Arivaca or Peña Planca Lake, there is little impetus for anglers to attempt to establish baitfish populations here. While this risk does exist, the probability is low.

Effects to critical habitat through introduction of nonnative fish species associated with the proposed action is not likely to occur.

Sonora chub will be considered in the global discussion of illegal and inadvertent transfer of unwanted aquatic organisms, diseases, and parasites.

### **Sonoyta mud turtle**

#### *Listing history*

The Sonoyta mud turtle (*Kinosternon sonoriense longifemorale*) is a candidate species for listing under the ESA. It became a candidate on September 19, 1997, and has a listing priority of 3 based on high magnitude of threats, immediacy of threats, and it is a subspecies. The most recent information on the subspecies was compiled for the 2010 Species Assessment and Listing Priority Assignment Form (USFWS 2010d) and the following information is abstracted from that document.

#### *Background*

The Sonoyta mud turtle is an isolated, endemic subspecies of mud turtle found only in and near the Rio Sonoyta drainage in Pima County in southwestern Arizona and northern Sonora, Mexico. In Arizona, the subspecies occurs only at Quitobaquito Spring on Organ Pipe Cactus National Monument (OPCNM). In Sonora, the subspecies is only found in seven sites; six locations in the Rio Sonoyta and one at Quitovac Spring (outside the Rio Sonoyta drainage), all within or near the town of Sonoyta.

The Sonoyta mud turtle population at Quitobaquito Spring declined from several hundred in the

1950s to less than 100 in the 1980s. Monitoring between 2000 and 2006 documented populations of around 100, with large numbers of young-of-the-year found in 2005 and 2006, which implied a potential for a population increase. Unfortunately, in 2007, the water levels at Quitobaquito Pond dropped precipitously, and individuals were translocated to a refuge site. Between 2008 and 2009, additional individuals were relocated to the refuge site which now supports 66 individuals. Some Sonoyta mud turtles likely remain in the pond. Sonoyta mud turtles will not be returned to Quitobaquito Pond until the water issues (leaks in the pond) have been corrected.

In Sonora, the population in the Rio Sonoyta occupies intermittent reaches of the Rio Sonoyta, an ephemeral dam pool and sewage lagoon, and the spring complex at Quitovac. The total population is considered stable and estimated at 1,200 individuals (range 600-2,700).

Threats to the Sonoyta mud turtle are largely related to loss of the aquatic habitats occupied by the subspecies due to groundwater withdrawals, elimination of effluent sources that support a portion of the population in Sonora, and water management problems (leaks) at Quitobaquito Pond. Other threats include environmental contaminants from pesticide use and in sewage effluent, watershed degradation by improper land management activities and introduction of nonnative plant species that alter riparian corridors or increase fire risks, and international border enforcement activities that may damage Quitobaquito Pond.

Illegal introduction of nonnative aquatic species is a threat to the Sonoyta mud turtle. Bullfrogs and crayfish are documented predators on other aquatic turtles, including the Sonoran mud turtle, a related subspecies, and do not currently occur in Sonoyta mud turtle habitats. Nonnative fish such as black bullhead and mosquitofish inhabit the Rio Sonoyta. Introduction of nonnative fish species to Sonoyta mud turtle habitats may not directly affect individuals through predation; however, competition for the available forage base (aquatic invertebrates, plants, frogs, and small fish) may lead to reduced fitness in the Sonoyta mud turtle. Examinations of adult Sonoyta mud turtles have identified nutritional stress under current conditions, with low lipid levels found, indicating low amounts of protein-rich foods. Without proper nutrition, growth is reduced and fewer healthier eggs can be produced. With the limited amount of habitat available for the subspecies, additional competition for resources may be significant.

The Quitobaquito/Rio Sonoyta Working Group was established in 2001 with agencies and groups representing interested parties in the United States and Mexico to develop a conservation strategy and agreement for the unique species of the Rio Sonoyta, including the Sonoyta mud turtle (AGFD 2011). Conservation measures completed, underway, or in the planning process include surveys in Mexico, development of a captive breeding program at the Phoenix Zoo, a population viability analysis to assist in population management, work on correcting the water problems at Quitobaquito Pond, and preservation and enhancement of Sonoyta mud turtle habitat at the Rio Sonoyta after the replacement of the existing sewage treatment plant.

Since 2000, the Sonoyta mud turtle has been considered in informal section 7 consultations with the National Park Service for OPCNM, and for Environmental Protection Agency-funded projects for the Sonoyta sewage treatment plant.



The AESO provided comments and recommendations to minimize effects and provide conservation to the Sonoyta mud turtle related to the expansion of the wastewater collection system and construction of a new wastewater treatment facility in Sonoyta funded by the Environmental Protection Agency (USFWS 2007a, 2008b). In 2008, the Mexican Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT) issued a Resolutivo with binding conditions for the project to negotiate an agreement with the Pinacate Biosphere Reserve to 1) ensure all treated water from the new facility is returned to the Rio Sonoyta, 2) build a pond for Sonoyta mud turtles near the new facility, and 3) hire a biologist to oversee management of these measures. Construction of the new facility was expected to begin in 2010 but is pending agreement on the conditions specified in the Resolutivo.

### *Effects analysis*

#### Direct effects

There are no direct effects to Sonoyta mud turtle from the proposed action. The habitat at Quitobaquito is not connected hydrologically to any stocking site.

#### Illegal and inadvertent transport effects

The effects to the Sonoyta mud turtle from the proposed action result from the component of the illegal transport of nonnative invertebrates, fish, amphibians, and reptiles that can be assigned to the continuation of the sportfish stocking program. The movement of species of stocked sportfish and bait (crayfish, waterdogs, frogs, or baitfish) used to fish at stocked sites to Quitobaquito Pond is an indirect effect of the proposed action.

Bullfrogs are known to prey on turtles and may be capable of impacting populations of mud turtles. Likewise, nonnative crayfish are known to prey on the Sonoran mud turtle (Schwendiman 2001) and their introduction has resulted in apparent marked population reductions at one Arizona locality (Fernandez and Rosen 1996). Concern has also been expressed over possible fish introduction into Quitobaquito Pond, particularly since golden shiners were introduced into the pond in the late 1960s and required considerable effort to eliminate (Minckley 1973, Minckley and Marsh 2009). This introduction was not considered to be the result of someone establishing a baitfish population, since the nearest fishery was in the Sea of Cortez and a freshwater baitfish would not likely be used (Minckley 1973). Some nonnative species, such as largemouth bass (*Micropterus salmoides*), are capable of preying on mud turtles; however, largemouth bass are not known from any of the habitats currently supporting the Sonoyta mud turtle. Additionally, mosquitofish and black bullhead (*Amieurus melas*) occupy the Rio Sonoyta (Hendrickson and Varela-Romero 1989). A black bullhead was found in the southwest spring of Quitobaquito in August 1993 and may have originated from there, carried into the pond by someone. In October 2003, a tilapia was observed in the Rio Sonoyta (USFWS unpublished data 2003). Although these nonnative species are not considered a direct threat to the Sonoyta mud turtle, they may have some adverse affects on the native fish fauna in the Rio Sonoyta, the endangered Quitobaquito pupfish (*Cyprinodon eremus*) and longfin dace (*Agosia chrysogaster*) that provide part of the natural prey base.

Individuals of several species of nonnative turtles have been documented in Quitobaquito. Smith and Hensley (1957) collected a mating pair of yellow mud turtles in 1955, originally described as *K. flavescens stejnegeri*, which was later subsumed into *K. flavescens arizonense* by Iverson (1979). These can compete for limited resources, introduce disease and parasites currently not known in the Sonoyta mud turtles, and potentially prey on hatchlings. No nonnative turtle species have been documented in the Rio Sonoyta, but this may be due to infrequent sampling than their overall absence. Released pet turtles and competition for resources will be an ongoing issue within the Rio Sonoyta basin.

Six stocking sites (La Paz County Park, Hidden Shores Pond, Yuma West Wetlands Park, Fortuna Pond, Redondo Lake, and Wellton Golf Course Pond) are part of the proposed action closest to Quitobaquito Pond. Species to be stocked in one or more of these six sites are rainbow trout, largemouth bass, bluegill, and channel catfish. Golden shiner and goldfish are legal baitfish on waters of La Paz and Yuma counties containing the six stocking sites. Bullfrogs, waterdogs, and crayfish are also legal for use as bait in those counties. Stocking of largemouth bass and/or channel catfish at the six sites provides opportunities to use legal bait. Except for rainbow trout, all the stocked sportfish and legal bait species have established populations in the Colorado and Gila rivers adjacent to the stocking sites.

The nearest stocking site to Quitobaquito Pond is at Wellton Golf Course Pond, over 180 road miles away. There are no waters on OPCNM or the adjacent Cabeza Prieta National Wildlife Refuge that provide fishing opportunities, so the impetus to bring stocked sportfish or legal bait species from the stocking sites to Quitobaquito Pond to establish populations of these species is limited. Of the species of concern, only golden shiner has ever been reported from Quitobaquito Pond.

### *Finding*

Direct effects to Sonoyta mud turtle from stocking sportfish into the lower Gila and lower Colorado Rivers stocking sites are unlikely to occur. The illegal or inadvertent movement of unwanted aquatic species to Quitobaquito by either anglers or members of the public is unlikely to occur.

However, stocking actions or illegal or inadvertent transport of unwanted aquatic organisms may contribute to the introduction or spread of parasites and diseases that may have adverse effects on Sonoyta mud turtle in the future. These effects are considered in the analysis as part of the environmental baseline and the cumulative effects.

## **Three Forks Springsnail**

### *Listing status*

The Three Forks springsnail was proposed for listing as an endangered species with proposed critical habitat on April 12, 2011 (USFWS 2011)

### *Background*

Three Forks springsnails are found at Three Forks Springs, which is an off-channel springs complex from the East Fork Black River located at Three Forks (13.7 miles downstream of Big Lake and 4.6 miles upstream from the East Fork stocking reach), and Boneyard Bog Springs, which is located at the headwaters of Boneyard Creek (18.4 miles downstream of Big Lake and 8.9 miles upstream of the East Fork stocking site via Boneyard Creek). All sites are on the ASNF. These springsnail sites are 34.1 and 38.4 miles, respectively, from Ackre Lake; a stocked fish would have to travel down Fish creek, and up the Black River, into the East Fork of the Black River, through the stocking reach in order to reach the Three Forks area.

Critical habitat was proposed for two occupied habitat areas; the Three Forks Spring Unit and Boneyard Bog Springs Unit. PBFs for the proposed critical habitat are:

1. Adequately clean spring water (free from contamination) emerging from the ground and flowing on the surface;
2. Periphyton (attached algae), bacteria, and decaying organic material for food;
3. Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation , for egg-laying, maturing, feeding, and escape from predators; and
4. Either an absence of nonnative predators (crayfish) and competitors (snails) or their presence at low population levels.

A significant threat to springsnails is crayfish. Carpenter and McIvor (1999) reported lower invertebrate diversity in sites at Three Forks that had higher densities of crayfish. Fernandez and Rosen (1996) reported significantly lower numbers and mass of invertebrates at sites with crayfish at Three Forks. The specific organisms that showed significant declines in the presence of crayfish during this study were caddisflies, snails, and a mussel (*Anadonta californiensis*). The Three Forks Springs population has been significantly affected by the invasion of nonnative crayfish. Crayfish are believed to have eliminated springsnails from springboxes where they had previously been abundant (Myers 2000). Crayfish trapping efforts have attempted to reduce the crayfish population, but elimination of crayfish via that method is not likely to occur. Crayfish have also affected the Boneyard Bog Springs springsnail population.

The Three Forks Fire in 2004 did not directly burn any of the springs holding springsnails. However, surface waters within the Three Forks fire area were exposed to fire retardant (chemicals used to suppress fire) that likely drifted from high elevation retardant releases from aircraft (USFS 2005). The population at Three Forks has reduced dramatically in size and surveys since 2004 rarely find more than two to six springsnails at a time (pers com. J. Sorenson) but they are present in low numbers (Cox 2007, Bailey 2008). Populations in Boneyard Bog Springs are abundant and were not affected by the 2004 retardant drops (Cox 2007).

The 2011 Wallow Fire burned in the watershed above the spring complex containing the springsnails. Salvage of springsnails was accomplished before any post-fire runoff could convey ash or sediment to the occupied habitat and proposed critical habitat. The amount of damage to the PBFs of proposed critical habitat from the post-fire runoff events is currently unknown, and damaging flows may occur over the next year. Springsnails still present in the system may be killed or injured during these events.

*Effects analysis*

The small spring systems occupied by the Three Forks Springsnail are not accessible to large-bodied fish such as the stocked trout species. Even if the stocked species reached Three Forks or Boneyard Bog, it is unlikely they could reach occupied springsnail habitat. Trout stocking in the East Fork Black River is not expected to impact the Three Forks springsnail at either Three Forks or Boneyard Bog, because the extant springs that still support the snail are too shallow (especially near the springheads where snails are found) for trout to successfully forage. Trout have not been observed anywhere near the springheads that still have snail populations in all the years they have monitored that species since 2004 (pers com J. Sorenson).

The North Fork East Fork Black River is a popular area for public recreation, and recreation has previously been identified as a threat to the species (USFWS 2007b). The Three Forks area is closed to public access by the ASNF the Boneyard Bog springs area has cattle fencing around it, and any vehicle access has been blocked by boulders; any recreational anglers would have to hike or 4x4 to the spring. Neither trampling nor habitat destruction from anglers is likely to occur since trout are not likely to reach the springs because of the shallow, boggy nature of the stream, and have never been observed at either Three Forks or Boneyard Bog Springs.

The concern related to the stocking program is the transmission of nonnative snails or mussels, particularly New Zealand mud snails (NZMS), via the water in stocking trucks that transport the fish from the hatchery. NZMS can displace native species and with a species of extremely limited distribution, this could result in extirpation or extinction. PBF 4 of proposed critical habitat would be adversely affected if this was to occur. However, this risk is extremely small. NZMS are not present at any hatcheries within Arizona, plus management plans to control or prevent snails or mussels from occupying hatcheries are in place. Many of the hatcheries use loaders that exclude organisms and water from the raceway, except for catchable size trout. Crescent Lake is stocked by the Canyon Creek, Tonto, and Sterling Springs state hatcheries. Big Lake is stocked by Canyon Creek, Page Springs and Sterling Springs hatcheries. The East Fork Black River is stocked almost exclusively by Silver Creek Hatchery. Canyon Creek Hatchery has a closed spring source that is piped the entire distance to the raceways. Tonto and Sterling Springs water sources are also piped into raceways. The fish loaders pick up fish and water from the water column of the raceway, not from the bottom, and sort the larger catchable trout into the stocking truck while smaller fish, raceway water, and any other organisms go back into the raceway. Water in the hatchery trucks are loaded directly from wells. Page Springs Hatchery has two water sources, one of which is secured (Pond Springs) and the other is partially secured (Cave Spring). It is unlikely that non target organism biota could become established due to the small area of exposed water before coming from the Cave Spring before it enters underground pipes. Moreover, the exposed portion of the Cave Spring is protected by a chain link fence, locked gate, and screened entrance. There are also metal screens that filter debris prior to entering the headbox and subsequent hatchery pipes. Introduction of non target organisms via more natural means (transmission via mammals or birds) is unlikely due to fast moving water which largely precludes use of Cave Spring by mammals and birds. The Silver Creek Hatchery is scheduled to undergo a complete renovation in 2010, which will completely cover the spring, and pipe the springwater into an indoor facility. It is unlikely that NZMS would become

established in these spring sources because of internal HACCP plans and hatchery procedural steps taken during day to day operation and maintenance, the remote locations of the springs, and also since the spring sources are not used by anglers that might transport NZMS on their wading gear. However, angler clothing or gear that is contaminated by NZMS due to pathways not associated with the proposed action (for example, fishing at sites not stocked under the proposed action where contamination could occur), still remains a threat to the Three Forks springsnail.

### *Finding*

The presence of HACCP and other management plans at the AGFD hatcheries intended to prevent the establishment of aquatic invasive species at the hatcheries and to reduce the risk of transporting such species during stocking operations provides several layers of defense for the Three Forks springsnail. This level of protection, while not absolute, is sufficient to reduce the risk of adverse effects to the species and proposed critical habitat from the proposed action to insignificant and discountable levels.

## **Woundfin 10j**

### *Listing status*

The Fish and Wildlife Service established “nonessential” experimental population areas for the woundfin in Arizona on July 24, 1985 (50 FR30188-30195). One of those sites, the Verde River from Horseshoe Dam to Perkinsville, contains the Middle Verde River stocking reach. The Tonto Creek site (Punkin Center to Gisela) is at the lower end of Tonto Creek miles below the stocking sites in the headwater area. The Gila River (backwaters of San Carlos Reservoir to the Arizona-New Mexico border) is not likely to be affected by stocking sites near Safford since they are all closed basins and fish from the stocking sites are not likely to access the Gila River. The San Francisco River (confluence with the Gila River to the Arizona-New Mexico border) is significantly removed from the Luna Lake stocking site and fish from that site would not be expected access the designated reach. The Hassayampa River site (Red Cliffs to Wagoner) is partly perennial through the vicinity of Wickenburg, with the lower section to the Gila River usually dry.

For section 7 purposes, under a “non-essential” experimental population, the individuals in that population are considered as proposed for listing as threatened and a conference may be conducted. The conference must consider the status of all populations of the species, natural or experimental, in determining if the proposed action is likely to jeopardize the continued existence of the species. However, by definition, a “nonessential experimental population” is not essential to the continued existence of the species, so no proposed action with an adverse effect to a population so designated can lead to a jeopardy determination for the entire species.

The designation of the nonessential experimental populations of woundfin in Arizona contained a section 4(d) rule that allowed the State of Arizona to regulate direct taking of woundfin from these populations through issuance of scientific collecting permits. For incidental take due to Federal actions requiring consultation, the woundfin in these populations are considered proposed for listing. Where an informal conference determines there is no likelihood of jeopardy

to a proposed species, a conference report is provided and it does not contain an incidental take statement. This document serves as the conference report for the nonessential experimental populations of woundfin in Arizona.

### *Stocking history*

On July 2, 2007, Arizona Game and Fish Department and The Nature Conservancy released 50 adult woundfin into the experimental reach near the TNC Hassayampa River Preserve. It is unknown if these fish reproduced or persisted in the river. Future stockings with woundfin into the Hassayampa River are uncertain; however, since they may occur within the 10-year period covered by this consultation, they will be evaluated. The other four designated reaches have not been recently stocked with woundfin and are not considered here.

### *Effects analysis*

Adult woundfin are often collected from runs and quiet waters adjacent to riffles. Larvae are found in backwaters or slowly moving water along the stream margin, and often are associated with dense growths of filamentous algae. Juveniles use habitats that are slower and deeper than those characteristic of adults. Woundfin greater than 1.6 inches total length are collected most frequently at depths between 0.48 and 1.4 feet, in current velocities ranging from 0.78 to 1.6 feet per second, over sand and sand-gravel substrate (Hardy et al. 1989). There is some indication that when water clarity is high, adult woundfin move into deeper water. The critical thermal maximum temperature for woundfin in the Virgin River is about 102 °F with mean preferred temperatures of about 52 to 75 °F, depending on the overall stream temperature (Deacon et al. 1987). Woundfin feed on a variety of items, including filamentous algae, detrital material, seeds, and aquatic insects; displaying a seasonal shift in food selectivity. Dietary overlap with introduced red shiners is greatest when food is most abundant. During periods of lower food abundance, woundfin and red shiners may experience greater competition for food, leading to a more pronounced partitioning of the food niche. Spawning has been documented from April to August (Hickman 1987; Hardy et al. 1989). The most significant threat to woundfin is from nonnative fish species, particularly red shiner, although other nonnative species such as largemouth bass, green sunfish, black bullheads, and channel catfish are potential predators (USFWS 1995b), especially if woundfin are in deeper water than they usually prefer.

Although woundfin, like most desert-evolved fish species, is resistant to downstream displacement by flooding (Minckley and Meffe 1987), data from extensive surveys in the Virgin River indicates that they will move downstream during flow events. If woundfin are displaced to the lower Hassayampa or to the Gila River approximately 35 miles below the experimental reach, they could be exposed to both warm and cold water species stocked under this program into the lower Salt River, the Salt River lakes, Tempe Town Lake, and those urban waters that drain into Tempe Town Lake. Predation may occur if woundfin and potential predators are in the same habitat.

The likelihood of woundfin and potential predators being in the same habitat in the lower Hassayampa/Gila River confluence is limited. The Hassayampa is normally dry below the experimental population reach and while connecting flows are not unknown, they are infrequent.

The Gila River at the confluence has some flow year round resulting from treatment plant effluent and agricultural return flows. The fish fauna in the Gila River below Tempe Town Lake is little studied; however, with the exception of walleye, all species proposed for stocking into the relevant sites have been recorded in the Gila River below Phoenix (Marsh and Minckley 1982). Flooding is known to displace nonnative fish downstream in the Salt River; yellow bass, present in the upstream lakes after 1931, was not documented in the Metropolitan Area until after the large floods of 1978-1979. After spills from Tempe Town Lake (resulting from water releases upstream on the Salt and Verde Rivers), fish are commonly observed in the drying pools below the dam. With extensive flooding as occurred in the spring of 2010, fish can be carried downstream to Painted Rock Reservoir, miles below the confluence of the Hassayampa and the Gila rivers.

The numbers of woundfin in the Hassayampa River available for transport downstream over the next 10 years is unknown. The status of the population as established has not been confirmed; however, given the limited numbers of fish stocked, successful establishment is questionable. The role of stocked fish or their progeny moved downstream from spill events at Tempe Town Lake in maintaining populations of these species in the Gila River is unknown, as is the numbers of such fish that would survive to encounter woundfin. The channels of the Salt and Gila rivers downstream of Tempe Town Lake are well defined and wide, with the opportunity for backwater and slower velocity areas where fish could escape from the highest velocities. It is unlikely that stocked fish could move up the Hassayampa River during floods, so the exposure to woundfin in the experimental reach is unlikely. There is, thus, a low, potential for woundfin and stocked fish to occupy the same habitats at the Gila/Hassayampa confluence; however, we do not believe this rises to a level where take may be expected to occur.

### *Finding*

The effects from stocked sportfish in the lower Salt River may affect, but is not likely to adversely affect the woundfin 10j population in the Hassayampa River. While the numbers of either woundfin or stocked sportfish available to be in the same habitats are not known, the likelihood is low and the opportunity for take is limited and unlikely to occur. Effects to this 10j woundfin population are, by definition, unable to result in jeopardy to the species.

## **Yellow-billed cuckoo**

### *Listing status*

In February 1998, a petition was filed with the FWS seeking endangered species status for the western subspecies of yellow-billed cuckoo (cuckoo). The 12-month finding for the petition was published 25 July 2001 indicating that endangered species status for the western continental United States population was warranted, but precluded by higher priority listing actions (USFWS 2001c). This species was added to the USFWS candidate species list where it currently remains.

### *Background*

Cuckoos are neotropical migratory birds that breed in late spring and summer along riparian

areas in Arizona (Groschupf 1987, Holmes et al. 2008, Halterman et al. 2009). For nesting habitat, they use dense cottonwood-willow and mesquite vegetation communities (Halterman 1991, Hughes 1999) with dense mid-story and undergrowth that provides shading and increased moisture to promote cooler temperatures (Rosenberg et al. 1991). Suitable habitat patches are wide (100-300 meters) and large (Laymon and Halterman 1989). All nesting areas are close to or adjacent to water or marshy areas that also may provide thermal refuge from the summer heat.

Migrating cuckoos arrive in Arizona between late May and June (Hughes 1999, Groschupf 1987). Nesting occurs primarily in July and August (Rosenberg et al. 1991, Hughes 1999) in sequence with a rise in abundance of large invertebrate prey items (Rosenberg et al. 1982, Hughes 1999). Cuckoos complete their nesting cycle (nest building to fledging) in less than three weeks (Hughes 1999) with the young still somewhat dependent on the adults for an additional three weeks (Laymon and Halterman 1985) until they can fly. While most cuckoos migrate out of Arizona in August and early September, there may still be birds present in some areas during mid-October (Corman and Wise-Gervais 2005).

Arizona probably contains the largest remaining cuckoo population among States west of the Rocky Mountain (USFWS 2001c).

*Determination of Exposure Potential:*

Sportfish stocking sites covered by this consultation may be in proximity to yellow-billed cuckoo habitats (Table 4), and the presence of anglers drawn by the fishing opportunities may result in disturbances to migrating or nesting cuckoos depending upon location and possibly some habitat degradation due to anglers accessing streams or lakes. To determine where such disturbance effects may occur, maps containing the stocking sites were overlain by maps showing where cuckoo habitats exist (Corman and Magill 2000).

Secondarily, the season of use for the stocked fish species was determined for each site. Cuckoos are only present in Arizona between May and early September and put-and-take stocking programs, such as for rainbow trout in the winter months near cuckoo habitat would not incur a potential for human disturbance although there may be habitat effects.

Table 4: Stocking sites with potential yellow-billed cuckoo exposure for habitat or disturbance effects during the time stocked sportfish may be present.

| Stocking Site           | Season of use for stocked species | Stocking site at or near habitat | Migration | Breeding (1998-2005) | Effect  |
|-------------------------|-----------------------------------|----------------------------------|-----------|----------------------|---------|
| Gila: Kearny            | All (warm water stocking)         | Off site                         |           |                      | None    |
| Little Colorado: Becker | All (peak use spring and fall)    | Off site                         |           |                      | None    |
| Salt: Lower Salt        | Winter/spring                     | Off site                         |           |                      | Habitat |



|                       |                            |           |   |                                                              |                         |
|-----------------------|----------------------------|-----------|---|--------------------------------------------------------------|-------------------------|
| Tempe Town Lake       | winter                     | Off site  |   |                                                              | None                    |
| Santa Cruz: Patagonia | Winter                     | Near site | Y |                                                              | Habitat                 |
| Verde: Watson         | All (warm water stocking)  | Off site  |   |                                                              | None                    |
| Willow                | All (warm water stocking)  | Off site  |   |                                                              | None                    |
| Goldwater             | All (warm and cold)        | Off site  |   |                                                              | None                    |
| Verde: Middle         | Nov-March<br>Winter/spring | At site   | Y | OC/VR conflu<br>WCC/VR con                                   | Habitat                 |
| Deadhorse             | All                        | Near site | Y | ?                                                            | Disturbance,<br>Habitat |
| Oak Creek             | March-Nov                  | At site   | Y | Page Springs<br>Oak Creek #3<br>Red Rock SP<br>Oak Creek #12 | Disturbance,<br>Habitat |
| West Clear Creek      | March-May<br>Oct-Nov       | At site   | Y | WCC<br>Campground                                            | Habitat                 |
| Wet Beaver Creek      | March-May<br>Oct-Nov       | At site   | Y | Y?                                                           | Habitat                 |

### *Effects Discussion:*

Effects to cuckoos from stocking sportfish are in two categories: 1) angler use of riparian areas that reduces habitat quality through creation of trails, trampling of understory, loss of vegetation recruitment, and opening of waterfront edges to create access; and 2) disturbance of nesting birds by human presence.

### Habitat effects

Riparian areas receive disproportionately high recreation use in the arid Southwest, when compared with other habitats. Anglers are a subset of the recreation component of activities and management actions that may impact riparian areas and cuckoo habitat (Manning 1979, Briggs 1996, Cole and Spildie 1998).

Riparian habitats impacts from recreation include: loss of surface soil horizons, soil compaction, altered soil moisture and temperature, altered soil microbiota, habitat fragmentation, reduced dead woody debris, altered plant species composition, altered foliage height diversity, reduced plant diversity/cover, lack of plant regeneration, erosion, increased sedimentation/turbidity of water, altered organic matter content of water, altered water chemistry, altered flow regimes, pollution, increased risk of accidental fire, increased trash, increased human waste and diseases, increased feral domestic animals and pet dogs, increased native predators, displacement of wildlife by facilities, and unauthorized roads and trails (USFWS 2002). The potential for the

recreational activity to produce negative impacts is highly dependent on the frequency, intensity, location and type of use the area receives. Infrequent but unpredictable recreational actions without patterns can cause more negative impacts per event than those predictable and frequent.

These stocking actions are an ongoing action that has a long history of occurring in these areas. As a result, we anticipate that anglers will likely continue to visit areas that they have visited in the past. To facilitate ease of access to the stream, anglers are expected to primarily stay on existing primitive foot trails or cattle/wildlife trails and/or walk between patches of dense vegetation. Additionally, we do not anticipate anglers once they reach their destination to be fishing in tight areas where vegetation is dense that causes casting to be difficult.

Areas with heavy human traffic may already be affected by other actions that contributed to the decline of habitat quality that also allows for easier access by humans. In areas without existing trails or paths, the density of cuckoo habitat tends to deter human entrance (Laymon 1998), so creation of new disturbance areas is unlikely.

#### Disturbance effects

Human-related disturbance during the migration period (either spring or fall) is likely to have a very limited effect on cuckoos since individuals are highly mobile and suitable migration habitat is more available than nesting habitat and avoidance of areas of high human use is more feasible. The information on the degree to which human presence in cuckoos nesting habitat can affect behavior of the adults and thus the success of the nesting attempt is not entirely consistent. Wiggins (2005) noted that any capture of adult birds for banding should not be done at the nest since the danger of abandonment of the nest is high. Similarly, he cautioned against banding the young birds while they are in the nest for the same reason. Latta et al. (1999) reported that YBCs will abandon nests if disturbed repeatedly and suggested avoidance of intense and repeated human disturbance in nesting areas between May 20 and September 1. Halterman (2010) indicated that a steady human presence during nest building or normal, regular human activity in the vicinity the effect to cuckoo is low, but more intensive use could result in nest failure. One report from Texas (Luneau 2002) documented nest abandonment during incubation by cuckoos after less than three minutes observation at a distance of 35 feet from the nest. At areas with high recreational use along lake shorelines, cuckoos were more abundant along transects with less recreational use (Robertson and Flood 1980). Cuckoos are not likely to abandon the nest once the first egg hatches and foraging birds are largely oblivious to human presence (Laymon 1998). The cuckoo survey protocol notes that cuckoos do not go to their nest if under observation, and that nest abandonment is a concern particularly during the nest building stage.

#### *Finding*

The proposed action may affect, but is not likely to adversely affect the habitat of yellow-billed cuckoo or disturb nesting birds.

Angler access to stocking sites has some potential to affect cuckoo habitat through trampling of plants and creating trails and paths through cutting or breaking branches through the under- or

mid-story vegetation. Other factors are more likely to create such trails or openings, and anglers are more likely to use existing access than to attempt to move through the dense growth that characterizes intact cuckoo habitat. Continued use of an area also results in loss of vegetation recruitment, through trampling and soil compaction. At the present time we do not believe these effects are significant enough to result in jeopardy.

Nesting yellow-billed cuckoos are present at only two sites (Deadhorse Ranch and Oak Creek) during the active stocking season, and at West Clear Creek and Wet Beaver Creek between the two stocking seasons (these two sites are stocked in spring and fall, not over the summer) but some anglers may be present at these sites during the breeding season. Nesting yellow-billed cuckoos are in dense habitat that is difficult to access, reducing the opportunity for anglers to get close to nests and cause disturbance. Yellow-billed cuckoos in heavily used recreation areas such as those under consideration likely nest away from trails and paths to avoid disturbances. At the present time, we do not believe these effects are significant enough to result in jeopardy.

As a conservation measure, AGFD will work with the Coconino, Prescott, and Tonto National Forests to evaluate impacts to physical habitat features along the occupied habitats on the Verde River from anglers accessing the stocking sites at the middle Verde River, Oak Creek, West Clear Creek, and Wet Beaver Creek.

### **Yuma clapper rail**

#### *Listing*

The Yuma clapper rail (clapper rail) was listed as an endangered species on March 11, 1967, pursuant to the Endangered Species Preservation Act of 1966 (32 FR 4001). The Yuma Clapper Rail Recovery Plan was signed in 1983 and is currently under revision (USFWS 2010e). The draft revised recovery plan contains the most up to date status of the species.

#### *Determination of exposure potential:*

Sportfish stocking sites covered by this consultation may be in proximity to clapper rail habitats and the activities of anglers drawn by the fishing opportunities may result in impacts to resident clapper rail. To determine where such impacts may occur, information on location of stocking sites and occupied/potentially occupied clapper rail habitats was compared to determine areas of potential impact, including if the habitat was at the site or along an adjacent waterway (Table 5). The potential for impacts at stocking sites vary with the species stocked and if stocking would occur during the breeding season.

Table 5: Stocking sites with potential YCR exposure for impacts related to sportfish stocking

| Stocking site                     | Season of use for stocked species | Location of habitat relative to stocking site | Human activities possible during breeding season | Potential for effects |
|-----------------------------------|-----------------------------------|-----------------------------------------------|--------------------------------------------------|-----------------------|
| <i>Lower Colorado River sites</i> |                                   |                                               |                                                  |                       |

|                               |                                 |                                                                                |     |     |
|-------------------------------|---------------------------------|--------------------------------------------------------------------------------|-----|-----|
| La Paz County Park            | Seasonal (fishing derbies only) | No habitat at site; habitat on Colorado River is not adjacent to site.         | No  | No  |
| Hidden Shores Golf Course     | Seasonal (fishing derbies only) | No habitat at site; habitat on Colorado River is not adjacent to site.         | No  | No  |
| Yuma West Wetlands Pond       | Seasonal (fishing derbies only) | No habitat at site; habitat on Colorado River is not adjacent to site.         | No  | No  |
| <i>Lower Gila River sites</i> |                                 |                                                                                |     |     |
| Fortuna Pond                  | Year round                      | Minimal cattail at site, adjacent portions of Gila River contain marsh habitat | Yes | Yes |
| Redondo Lake                  | Year round                      | Minimal cattail at site, adjacent portions of Gila River contain marsh habitat | Yes | Yes |
| Wellton Golf Course Pond      | Seasonal (fishing derbies only) | No habitat at site; habitat on Gila River is several miles away                | No  | No  |
| <i>Salt River sites</i>       |                                 |                                                                                |     |     |
| Apache Lake                   | Year round                      | No cattail areas on lake                                                       | No  | No  |
| Canyon Lake                   | Year round                      | No cattail areas on lake                                                       | No  | No  |
| Saguaro Lake                  | Year round                      | On site                                                                        | Yes | Yes |
| Lower Salt River              | Winter/spring                   | On site                                                                        | Yes | Yes |
| Tempe Town Lake               | Winter/spring                   | No cattail areas on lake. Habitat above lake on Salt River                     | No  | No  |

*Effects analysis*

Clapper rails are secretive marsh birds that are found in cattail and cattail bulrush marshes along the lower Colorado, Gila, and Salt rivers in Arizona. They are seldom seen as they tend to remain in dense cover provided by marsh and adjacent low-growing riparian vegetation. They are generally presumed to be resident and non-migratory along the lower Colorado and lower Gila rivers (Eddleman 1989); however, it is uncertain if the Gila River/Phoenix metro population remains in the area year round (Corman and Wise-Gervais 2005).

Potential effects to clapper rails from activities of anglers pursuing stocked sportfish are in three categories: 1) creation or maintenance of trails to access fishing sites; 2) disturbance of individuals by human presence or noise; and 3) exposure to lead from discarded fishing tackle or entanglement in monofilament attached to dead fish.

Habitat for clapper rails is dense marsh (cattail and bulrush) with a mix of riparian shrub and tree species along the shoreline with interspersed areas of open, shallow (less than one foot deep) water with some bare ground areas for foraging and movement (summarized in USFWS 2010e). Minimum patch size for clapper rail habitat has not been established; however, information on sizes of home ranges and resultant management recommendations suggest creation of patches at least 20 acres in size (summarized in USFWS 2010e). Use of smaller habitat areas is documented (USFWS compiled annual survey data), and these sites likely contain lower numbers of pairs than the larger, more contiguous marsh areas. Dense clapper rail habitat is not conducive to angling, although the open water along the edges of the marsh is used if shore access between marsh patches or boat access is available. Creation of trails or paths through cattails or bulrush to access open water may occur where other access is limited; however, where open areas exist those are more likely to be utilized.

Clapper rails initiate breeding activities with pair-bonding calls in February with initiation of nesting in March with a peak in May on the lower Colorado River (Eddleman 1989). Along the Gila River in the metropolitan Phoenix area, calling is later (March) with nesting probably peaking later in the spring than along the lower Colorado River. Nests are constructed in dense vegetation within the marsh or associated riparian vegetation. Young clapper rails are cared for by the adults for several weeks following hatching (Eddleman and Conway 1998). Adults molt during the summer and are flightless during that period.

Information on the effects of noise or human presence on clapper rails is very limited. Annual survey information indicates that YCR can be found in close proximity to areas of human activities (recreation areas, boat ramps, roads) where those activities have been ongoing for many years. The size of the available habitat may be important as larger areas can provide larger buffer areas or refuge sites than smaller habitats. Clapper rails in these areas may be tolerant of the existing level of potential disturbance through having sufficient habitat area and acclimation. While clapper rails are secretive, examples exist of them crossing roads or launch ramps in front of vehicles or humans. The amount of disturbance reaching the occupied habitat will vary depending on the distance between the disturbance and the habitat, as noise attenuates over distance.

Crayfish, small fish, tadpoles, clams, and other aquatic invertebrates comprise the diet of all life stages of clapper rails (summarized in USFWS 2010e). Stocked fish may compete with clapper

rails for invertebrate foods; however, the foraging sites of YCR tend to be on mudflats and in vegetative cover where fish are unlikely to access. They hunt by sight and have an acute sense of smell (Eddleman and Conway 1998) but it is unknown if they use dead fish. Only one reference cited in Eddleman and Conway (1998) mentioned carrion as a minor food source, but it was not clear if this was dead fish or other dead animals. Their bills are not designed to dismember large prey items, so their ability to utilize moribund fish containing hooks or other fishing tackle is likely reduced. The secretive nature of the clapper rails reduces the potential for any individual caught in fishing line to be located; however, this is not identified in the literature as an issue for clapper rails in general. Clapper rails may be exposed to lead from sinkers or jigs lost from angling activities. Jones (1939) noted that the probing for animal foods feeding style of clapper rails reduced the likelihood of them ingesting lead shot pellets (only five instances were found in 423 stomachs), and with the use of steel shot for waterfowl hunting, this avenue of exposure is likely reduced. The compiled research on ingestion of lead sinkers or jigs does not document occurrences in clapper rails (Perry 1994, Schuehammer et al. 2003).

*Effects Analysis: Habitat:*

Angler access to stocking sites through clapper rail habitat may result in trampling of some vegetation, particularly the adjacent riparian shrubs. Attempts to create trails through extant cattail patches would be extremely difficult. Existing trails created by recreationists, including anglers, do fragment habitat patches; however, these are limited in scope and the resultant open area can be used by clapper rails for foraging when humans are not present. Where there is no or small amounts of cattail/bulrush habitat at a stocking site, it is unlikely to be used by clapper rails.

*Effects Analysis: Disturbance:*

Literature on clapper rails does not suggest they are particularly vulnerable to disturbance events even during nesting. Nests are sheltered within dense habitats, and noise from human presence likely attenuates due to the vegetation and distance from the source. Boat motors may be heard within habitats; however, anglers with boats approaching marshes to fish in the open water area generally at low speeds with reduced noise.

*Effects Analysis: Fishing tackle:*

The presence of discarded monofilament line or broken line with hooks or other tackle attached to moribund fish has not been identified as an issue of concern for clapper rails, which are not known to feed on dead fish. While there is some past evidence of lead shot in clapper rails, no records for ingestion of lead sinkers or jigs was found in the literature.

*Finding*

Clapper rails are unlikely to be affected by stocking actions at La Paz County Park, Hidden Shores Golf Course, Yuma West Wetlands Pond, Wellton Golf Course Pond, Tempe Town Lake, Apache Lake, or Canyon Lake.

YCR may be slightly affected by disturbance from anglers at Fortuna Pond, Redondo Lake, the lower Salt River, and Saguaro Lake. The level of this potential disturbance is low and not significant.

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## Appendix F

### Scientific Names of Species Mentioned in the Text of the BCO

#### 1. Scientific names of consultation species

| Class                | Scientific name                               | Common name                    |
|----------------------|-----------------------------------------------|--------------------------------|
| <i>Invertebrates</i> |                                               |                                |
|                      | <i>Pyrgulopsis morrisoni</i>                  | Page springsnail               |
|                      | <i>Pyrgulopsis trivialis</i>                  | Three Forks springsnail        |
| <i>Amphibians</i>    |                                               |                                |
|                      | <i>Hyla wrightorum</i>                        | Arizona treefrog               |
|                      | <i>Lithobates chiricahuensis</i>              | Chiricahua leopard frog        |
|                      | <i>Lithobates pipiens</i>                     | Northern leopard frog          |
|                      | <i>Ambystoma mavortium stebbinsi</i>          | Sonoran tiger salamander       |
| <i>Reptiles</i>      |                                               |                                |
|                      | <i>Thamnophis rufipunctatus</i>               | Narrow-headed gartersnake      |
|                      | <i>Thamnophis eques megalops</i>              | Northern Mexican gartersnake   |
|                      | <i>Kinosteron sornoriense longifemorale</i>   | Sonoyta mud turtle             |
| <i>Fish</i>          |                                               |                                |
|                      | <i>Oncorhynchus apache</i>                    | Apache trout                   |
|                      | <i>Gila elegans</i>                           | Bonytail                       |
|                      | <i>Ptychocheilus lucius</i>                   | Colorado pikeminnow            |
|                      | <i>Cyprinodon macularius</i>                  | Desert pupfish                 |
|                      | <i>Gila intermedia</i>                        | Gila chub                      |
|                      | <i>Poeciliopsis occidentalis occidentalis</i> | Gila topminnow                 |
|                      | <i>Oncorhynchus gilae</i>                     | Gila trout                     |
|                      | <i>Gila nigra</i>                             | Headwater chub                 |
|                      | <i>Gila cypha</i>                             | Humpback chub                  |
|                      | <i>Lepidomeda vittata</i>                     | Little Colorado spinedace      |
|                      | <i>Tiaroga cobitis</i>                        | Loach minnow                   |
|                      | <i>Cyprinodon eremus</i>                      | Quitobaquito pupfish           |
|                      | <i>Xyrauchen texanus</i>                      | Razorback sucker               |
|                      | <i>Gila robusta</i>                           | Roundtail chub                 |
|                      | <i>Gila ditaenia</i>                          | Sonora chub                    |
|                      | <i>Meda fulgida</i>                           | Spikedace                      |
|                      | <i>Plagopterus argentissimus</i>              | Woundfin                       |
| <i>Birds</i>         |                                               |                                |
|                      | <i>Strix occidentalis lucida</i>              | Mexican spotted owl            |
|                      | <i>Empidonax traillii extimus</i>             | Southwestern willow flycatcher |
|                      | <i>Coccyzus americanus</i>                    | Yellow-billed cuckoo           |
|                      | <i>Rallus longirostris yumanensis</i>         | Yuma clapper rail              |
| <i>Mammals</i>       |                                               |                                |
|                      | <i>Canis lupus baileyi</i>                    | Mexican wolf                   |
|                      | <i>Tamiasciurus hudsonicus grahamensis</i>    | Mount Graham red squirrel      |

|  |                               |                                 |
|--|-------------------------------|---------------------------------|
|  | <i>Zapus hudsonius luteus</i> | New Mexico meadow jumping mouse |
|--|-------------------------------|---------------------------------|

## 2. Abbreviations for scientific names of stocked fish species

| Abbreviation | Scientific name               | Common name     |
|--------------|-------------------------------|-----------------|
| CTID         | <i>Ctenpharyngodon idella</i> | Grass carp      |
| DOPE         | <i>Dorosoma petenense</i>     | Threadfin shad  |
| ICPU         | <i>Ictalurus punctatus</i>    | Channel catfish |
| LEMA         | <i>Lepomis macrochirus</i>    | Bluegill        |
| LEMI         | <i>Lepomis microlophus</i>    | Redear sunfish  |
| MIDO         | <i>Micropterus dolomieu</i>   | Smallmouth bass |
| MISA         | <i>Micropterus salmoides</i>  | Largemouth bass |
| ONAP         | <i>Oncorhynchus apache</i>    | Apache trout    |
| ONCL         | <i>Oncorhynchus clarki</i>    | Cutthroat trout |
| ONGI         | <i>Oncorhynchus gilae</i>     | Gila trout      |
| ONMY         | <i>Oncorhynchus mykiss</i>    | Rainbow trout   |
| PEFL         | <i>Perca flavescens</i>       | Yellow perch    |
| POAN         | <i>Pomoxis annularis</i>      | White crappie   |
| PONI         | <i>Pomoxis nigromaculatus</i> | Black crappie   |
| SAFO         | <i>Salvelinus fontinalis</i>  | Brook trout     |
| SATR         | <i>Salmo trutta</i>           | Brown trout     |
| SAVI         | <i>Sander vitreus</i>         | Walleye         |
| THAR         | <i>Thymallus arcticus</i>     | Arctic grayling |

## 3. Abbreviations for scientific names of other fish species mentioned in the text

| Abbreviation | Scientific name                | Common name     |
|--------------|--------------------------------|-----------------|
| AMME         | <i>Ameiurus melas</i>          | Black bullhead  |
| AMNA         | <i>Ameiurus natalus</i>        | Yellow bullhead |
| CYCA         | <i>Cyprinus carpio</i>         | Common carp     |
| ESLU         | <i>Esox lucius</i>             | Northern pike   |
| GAAF         | <i>Gambusia affinis</i>        | Mosquitofish    |
| LECY         | <i>Lepomis cyanellus</i>       | Green sunfish   |
| NOCR         | <i>Notemigonus crysoleucas</i> | Golden shiner   |

## 4. Scientific names of other species mentioned in the text

| Class                     | Scientific Name                         | Common Name                |
|---------------------------|-----------------------------------------|----------------------------|
| <i>Diseases/parasites</i> |                                         |                            |
|                           | <i>Lernaea cyprinacea</i>               | Anchor worm                |
|                           | <i>Bothriocephalus acheilognathi</i>    | Asian tapeworm             |
|                           | <i>Batrachochytrium dendrobatidis</i>   | Chytrid fungus             |
|                           | <i>Ichthyophirius numtifiliis</i>       | Ich                        |
| <i>Invertebrates</i>      |                                         |                            |
|                           | <i>Corbicula manilensis [=fluminea]</i> | Asiatic clam               |
|                           | <i>Eriocheir sisenis</i>                | Mitten crab                |
|                           | <i>Potamopyrgus antipodarum</i>         | New Zealand mud snail      |
|                           | <i>Dreissena bugensis</i>               | Quagga mussel              |
|                           | <i>Procamberus clarki</i>               | Red swamp crayfish         |
|                           | <i>Orconectes virilis</i>               | Virile (northern) crayfish |
|                           | <i>Dreissena polymorpha</i>             | Zebra mussel               |
| <i>Fishes</i>             |                                         |                            |
|                           | <i>Catostomus clarki</i>                | Desert sucker              |
|                           | <i>Lepomis marginatus</i>               | Dollar sunfish             |
|                           | <i>Pimephales promelas</i>              | Fathead minnow             |
|                           | <i>Dorosoma cepedianum</i>              | Gizzard shad               |
|                           | <i>Micropterus treculi</i>              | Guadalupe bass             |
|                           | <i>Percina</i> sp.                      | Logperch                   |
|                           | <i>Canna canna</i>                      | Snakehead                  |
|                           | <i>Catostomus insignis</i>              | Sonora sucker              |
|                           | <i>Rhinichthys osculus</i>              | Speckled dace              |
| <i>Amphibians</i>         |                                         |                            |
|                           | <i>Lithobates catesbeiana</i>           | American bullfrog          |
|                           | <i>Lithobates yavapaiensis</i>          | Lowland leopard frog       |
|                           | <i>Lithobates blairi</i>                | Plains leopard frog        |
|                           | <i>Lithobates berlandieri</i>           | Rio Grande leopard frog    |
|                           | <i>Ambystoma maculatum</i>              | Spotted salamander         |
|                           | <i>Ambystoma tigrinum</i>               | Tiger salamander           |
|                           | <i>Lithobates sylvatica</i>             | Wood frog                  |
|                           | <i>Bufo woodhousei</i>                  | Woodhouse's toad           |
| <i>Birds</i>              |                                         |                            |
|                           | <i>Haliaeetus leucocephalus</i>         | Bald eagle                 |
|                           | <i>Corvus brachyrhynchos</i>            | Common crow                |
|                           | <i>Corvus corax</i>                     | Raven                      |
| <i>Mammals</i>            |                                         |                            |
|                           | <i>Lontra canadensis</i>                | Otter                      |
| <i>Plants</i>             |                                         |                            |
|                           | <i>Alnus oblongifolia</i>               | Arizona alder              |

|  |                               |                       |
|--|-------------------------------|-----------------------|
|  | <i>Juglans major</i>          | Arizona black walnut  |
|  | <i>Platanus wrightii</i>      | Arizona sycamore      |
|  | <i>Rubus</i> spp.             | Blackberry            |
|  | <i>Vitis arizonica</i>        | Canyon grape          |
|  | <i>Myriophyllum spicatum</i>  | Eurasian watermilfoil |
|  | <i>Populus fremontii</i>      | Fremont cottonwood    |
|  | <i>Quercus gambelii</i>       | Gambel oak            |
|  | <i>Pinus ponderosa</i>        | Ponderosa pine        |
|  | <i>Fraxanus pennsylvanica</i> | Velvet ash            |
|  | <i>Salix</i> spp.             | Willows               |
|  | <i>Tamarix</i> spp            | Saltcedar             |
|  | <i>Salvinia molesta</i>       | Salvinia              |

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