United States Department of the Interior

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APR 2 9 2005

Mark J. Madrid
Forest Supervisor
U.S. Forest Service
Payette National Forest
P.O. Box 1026
McCall, Idaho 83631

Subject: Emergency Consultation for Nick Fire Retardant Drop – Biological Opinion
File #113.0300 ~~O~~ALS #1-4-04-F-361

Mark

Dear ~~Mr. Madrid~~:

With this letter, the Fish and Wildlife Service (Service) is providing you with our Biological Opinion (Opinion) that fire suppression actions taken on the Nick Fire in Valley County, Idaho and did not jeopardize bull trout (*Salvelinus confluentus*). In a letter dated February 15, 2005 and received by the Service on February 17, 2005, the Payette National Forest (Forest) requested completion of emergency consultation on the actions described in a Biological Assessment (Assessment). Your request is in accordance with the Endangered Species Act of 1973 (Act), as amended (16 USC 1531 et seq.). You determined that the emergency actions adversely affected bull trout.

This letter and attached Opinion serve to conclude consultation for the Nick Fire retardant drop for species under section 7 of the Act. Potential impacts to other listed or proposed species not specifically addressed in your correspondence or accompanying Assessment have not been examined through this consultation in relation to the subject action.

TAKE PRIDE IN AMERICA

Thank you for your continued interest in the conservation of endangered, threatened, and proposed species. If you have any questions regarding this consultation, please contact Allyson Turner at (208) 685-6952.

Sincerely,

for Jeffery L. Foss, Field Supervisor
Snake River Fish and Wildlife Office

Enclosure
cc: FWS, Portland (Salata) (electronic)
Krassel RD, McCall (Carver)
PNF SO, McCall (Burns)
NOAA, Boise (Artimez)

BIOLOGICAL OPINION
FOR THE
NICK FIRE RETARDANT DROP
PAYETTE NATIONAL FOREST, MCCALL
VALLEY COUNTY, IDAHO
1-4-05-F-361

APRIL 2005
FISH AND WILDLIFE SERVICE
SNAKE RIVER FISH AND WILDLIFE OFFICE
BOISE, IDAHO

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Introduction

The Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) in response to the Payette National Forest's (Forest) request for consultation on the effects of Fire Suppression Actions outside of their existing programmatic consultation associated with the Nick Fire in Valley County, Idaho. The Forest analyzed effects of the emergency actions on bull trout (*Salvelinus confluentus*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended. In this Opinion, we have concluded the action did not jeopardize the bull trout. This Opinion is based on information provided in the February 11, 2005 Biological Assessment (Assessment) and conversations with your staff. A complete administrative record of this consultation is on file at this office.

Consultation History

The following correspondence and meetings have taken place between the Forest and the Service prior to the issuance of this Opinion.

August 6, 2004	The Nick Fire was reported to Payette National Forest dispatch by the Williams Peak fire lookout. Use of fire retardant was requested and approved, and 2500 gallons of Fire-Trol Retardant was dropped on the Nick Fire.
August 7, 2004	Krassel Ranger District Fire personnel walked the area where retardant had been dropped and discovered that retardant had entered Nick Creek.
August 11, 2004	Notification of the emergency situation was provided to the Service via email.
August 30 and September 1, 2004	Updates on the retardant drop were provided to the Service via email.
January 5, 2005	A draft Assessment discussing effects of the subject actions was submitted to the Service for review.
January 19, 2005	Forest Level 1 interagency streamlined consultation team, including representatives of the Service and NOAA Fisheries, met and discussed the subject project.
February 17, 2005	A final version of the Assessment was submitted to the Service and formal consultation began at this time.

BIOLOGICAL OPINION

I. Description of the Federal Actions

A. Action Area

An action area is defined as all areas affected directly or indirectly by the proposed Federal action. The action area for the Nick Fire Retardant Drop is Nick Creek and West Fork Buckhorn Creek in the South Fork of the Salmon River Watershed. The area surrounding Section 3, Township 18 North, Range 5 East, where the retardant drop occurred, is within the South Fork of the Salmon River 5th Hydrologic Unit.

B. Emergency Action

The emergency Federal action encompassed activities related to fire suppression that were not analyzed for effects in the 2001 Assessment for programmatic actions in the South Fork Salmon River Watershed (USDA 2001), or that were not implemented consistently with that programmatic consultation and have the potential to affect listed species.

The Forest's programmatic consultation for fire suppression activities in the South Fork of the Salmon River Watershed (2001), considered aerial application of water and chemical fire retardants (including Fire-trol). However, the subject action did not comply with all of the criteria presented in that analysis, hence this emergency consultation is warranted. The following criteria were not met.

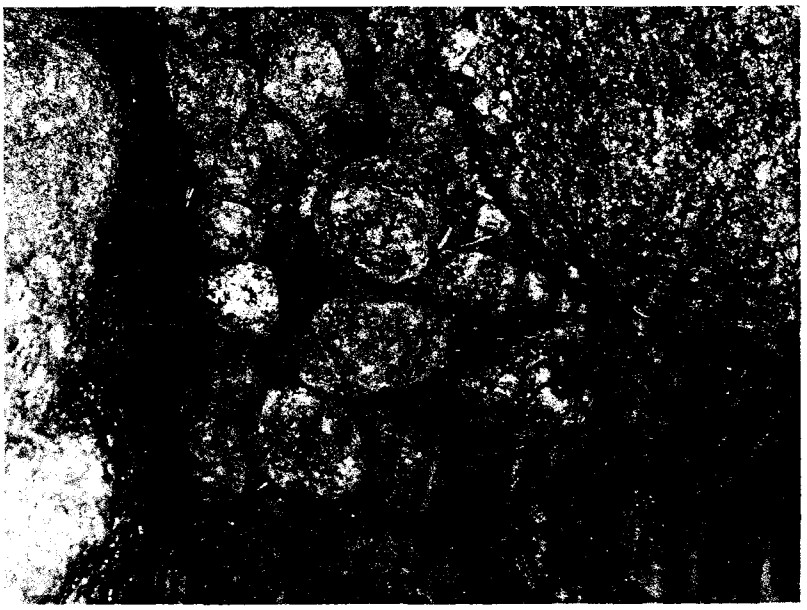
- Do not use chemicals when there is a potential for direct stream contamination.
- Minimize the application of retardant near live streams. Do not drop retardant or foam directly in streams or adjacent riparian areas.
- The Forest will develop a contingency plan identifying procedures to be initiated should a chemical spill or contamination occur.

During suppression for the Nick Fire, which was reported to Forest Dispatch on August 6, 2004, the use of fire retardant was approved. After 2,500 gallons of Fire-Trol Retardant had been dropped on the Nick Fire, Krassel Ranger District personnel became aware of the drop and advised Forest dispatch to, "Remind Air Attack that it is a priority to keep retardant out of streams." The Nick Fire was suppressed for the next several days using helicopter buckets, hoselays, and other suppression techniques analyzed for effects in USDA (2001), and consistent with that Assessment.

Several days after the retardant drop occurred, Forest personnel walked the fire area and discovered that retardant had been dropped into Nick Creek. It was estimated that approximately 300 to 600 gallons of retardant entered Nick Creek. Because of weather and helicopter availability, a reconnaissance review was not conducted for several weeks.

Obvious signs of retardant were detected within 250 feet of Nick Creek on rocks, terrestrial substrate (Figure 1), and riparian vegetation. Retardant was also observed in the stream substrate in pool habitat. No dead organisms were observed, and some live fish were seen.

Figure 1. Photo of retardant on substrate in a pool in Nick Creek, following the Nick Fire retardant drop. (Photo provided by Payette National Forest)



II. Status of the Species

A. Species Description

Bull trout *(Salvelinus confluentus)*, member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978; Bond 1992). To the west, bull trout range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout are wide-spread throughout the Columbia River basin, including its headwaters in Montana and Canada and also occur in the Klamath River basin of south central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978; Brewin and Brewin 1997).

Bull trout were first described as *Salmo spectabilis* by Girard in 1856 from a specimen collected on the lower Columbia River, and subsequently described under a number of names such as *Salmo confluentus* and *Salvelinus malma* (Cavender 1978). Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species (Cavender 1978; Bond 1992). Cavender (1978) presented morphometric (measurement), meristic (geometrical relation),

osteological (bone structure), and distributional evidence to document specific distinctions between Dolly Varden and bull trout. The American Fisheries Society formally recognized bull trout and Dolly Varden as separate species in 1980 (Robins et al. 1980).

On June 10, 1998, the Service issued a final rule listing the Columbia River and Klamath River populations of bull trout as threatened (63 FR 31647) under the authority of the Act. With the listing as threatened of the Jarbidge River population (64 FR 17110, November 1, 1999) and the Coastal-Puget Sound and St. Mary-Belly River populations (64 FR 58910, November 1, 1999), all bull trout in the coterminous United States received full protection under the Act.

B. Life History

Bull trout exhibit resident and migratory life-history strategies through much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for one to four years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous), where they reach maturity (Fraley and Shepard 1989; Goetz 1989). Resident and migratory forms often occur together, and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear, and that the characteristics are not necessarily ubiquitous throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997).

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8°C (44 to 46°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 to 9°C (46 to 48°F) within a temperature gradient of 8 to 15°C (46 to 60°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot

River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997).

Preferred spawning habitat consists of low gradient streams with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9°C (41 to 48°F) in late summer to early fall (Goetz 1989). High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentages of fine sediments (Shepard et al. 1984). Pratt (1992) indicated that increases in fine sediments reduce egg survival and emergence.

The size and age of bull trout at maturity depends upon life-history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Fraley and Shepard 1989; Goetz 1989). Bull trout normally reach sexual maturity in four to seven years and live as long as 12 years. Repeat and alternate year spawning has been reported, although repeat spawning frequency and post-spawning mortality are not well known (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Spawning primarily occurs during September in the North Fork Clearwater basin (CBBTTAT 1998), and similar dates are expected for the Salmon and Boise River basins. However, migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (155 miles) to spawning grounds (Fraley and Shepard 1989). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Bull trout are opportunistic feeders with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989; Donald and Alger 1993).

C. Population Dynamics

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989) and resident bull trout move to overwinter in downstream pools in tributaries of the Bitterroot River (Jakober 1995). The ability to migrate is important to the persistence of local bull trout subpopulations (Rieman and McIntyre 1993; M. Gilpin, University of California, in litt. 1997; Rieman et. al. 1997). Migrations facilitate gene flow among local subpopulations because individuals from different subpopulations interbreed when some stray and return to non-natal streams. Subpopulations that are extirpated by catastrophic events may also become reestablished in this manner.

Metapopulation concepts of conservation biology theory are applicable to the distribution and characteristics of bull trout (Rieman and McIntyre 1993). A metapopulation is an interacting network of local subpopulations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994). Local subpopulations may become extinct, but can be reestablished by individuals from other subpopulations. Metapopulations provide a mechanism for reducing the risk of extirpation because the simultaneous loss of all subpopulations is unlikely. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions that create unsuitable conditions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout often in the headwaters of tributaries (Rieman et al. 1997).

D. Status and Distribution

Though wide-ranging in parts of Oregon, Washington, Idaho and Montana, bull trout in the interior Columbia River basin presently occur in only about 44 percent of the historical range (Quigley and Arbelbide 1997; Rieman et al. 1997). Declining trends and associated habitat loss and fragmentation have been documented rangewide (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; Newton and Pribyl 1994; Idaho Department of Fish and Game (IDFG), in litt. 1995). Several local extirpations have been reported, beginning in the 1950s (Rode 1990; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994; Newton and Pribyl 1994; Berg and Priest 1995; Light et al. 1996; Buchanan and Gregory 1997; Washington Department of Fish and Wildlife 1997).

1. Columbia River Distinct Population Segment

The Columbia River Distinct Population Segment (DPS) includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). The Columbia River DPS has declined in overall range and numbers of fish. The population segment is composed of 141 subpopulations indicating habitat fragmentation, isolation, and barriers limit bull trout distribution and migration within the basin. Although some fluvial bull trout strongholds still exist, bull trout generally occur as isolated subpopulations in headwater lakes or tributaries where migratory fish have been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (IDFG in litt. 1995).

2. Snake River Geographic Area

Bull trout occupy portions of 14 major tributaries in the Snake River basin of Idaho, Oregon, and Washington. The Service identified 34 bull trout subpopulations in the Snake River basin. Downstream of Hell's Canyon Dam, major tributaries that support bull trout include (number of subpopulations)--Tucannon River (2), Clearwater River (3), Asotin Creek (2), Grande Ronde River (1), Imnaha River (4), and Salmon River (2). Upstream of Hells Canyon Dam, major tributaries that support bull trout include--Pine Creek (4), Powder River (3), Malheur River (2), Payette River (4), Weiser River (2), and Boise River (2). Although bull trout distribution upstream of Hell's Canyon Dam is limited primarily to the basin downstream of Shoshone Falls

in southern Idaho, three geographically isolated bull trout subpopulations occur upstream of Shoshone Falls in the Little Lost River drainage. Bull trout subpopulations upstream of Hell's Canyon Dam are generally low in abundance, fragmented, and isolated. Numerous impassable dams and large expanses of unsuitable habitat have isolated subpopulations. Isolation is most prominent upstream of Hell's Canyon Dam in southwest Idaho and southeast Oregon.

The basin downstream of Hell's Canyon Dam is relatively intact, and connectivity among bull trout subpopulations may still occur there. The species occupies large areas of contiguous habitat in the Snake River basin downstream of Hell's Canyon Dam, such as in the Clearwater River and Salmon River basins. High numbers of bull trout have been observed in the Tucannon River, Imnaha River, Clearwater River, Salmon River, and Malheur River subpopulations, however, trends in abundance are largely unknown or declining.

3. Salmon River Basin

The Salmon River basin lies in Central Idaho and extends from the Idaho/Montana border on the east to the Snake River on the Idaho/Washington border in the west. Bull trout are currently known to use spawning and rearing habitat in at least ten watersheds (i.e., core areas) in the Salmon River basin. These watersheds include, Upper Salmon River, Pahsimeroi River, Lake Creek, Lemhi River, Middle Salmon River-Panther, Opal Lake, Middle Fork Salmon River, Middle Salmon-Chamberlain, South Fork Salmon River, and Little-Lower Salmon River. The Service identified two bull trout subpopulations in the Salmon River basin at the time of listing (63 FR 31647). These subpopulations are the Salmon River and Little Salmon-Rapid River, and the abundance trends were listed as decreasing in the status review at the time of listing (Service 2002).

Bull trout occupy much of the mainstem Salmon River and associated tributary systems. This basin lacks major dams on the mainstem rivers so there is likely connectivity among core areas. Bull trout spawning occurs in the higher elevation streams throughout this basin (Service 2002). Idaho Department of Fish and Game has collected a plethora of data on anadromous fish and along with it only incidental information on bull trout in the Salmon River basin. Anadromous fish and bull trout distributions overlap throughout much of the basin, but there are areas where populations of bull trout exist upstream of barriers for anadromous fish (Service 2002). Hence, specific information about spawning, rearing, timing of migration, and habitat use for bull trout is severely lacking in much of the basin.

4. South Fork Salmon River Subbasin

The *Section 7 Watershed Biological Assessment for the South Fork Salmon River Drainage*, (USDA 2001) and the Service's Draft Bull Trout Recovery Plan (Service 2002) summarized the overall presence/absence, relative abundance, habitat conditions and current trends for bull trout in the South Fork Salmon River drainage. Bull trout are currently known to use spawning and rearing habitat in at least 27 streams or stream complexes (i.e., local populations). These local populations include Upper Lake Creek, Grouse-Flat Creek, Ruby Creek, Summit Creek, Victor Creek, Loon Creek, Lick Creek, Zena Creek, Fitsum Creek, Buckhorn Creek, Couger Creek, Fourmile Creek, Blackmare Creek, Dollar-six Bit Creeks, Warm Lake, Curtis Creek, Upper

South Fork Salmon River, Burntlog Creek, Trapper Creek, Riordan Creek, Upper East Fork South Fork Salmon River, Sugar Creek, Tamarack Creek, Profile Creek, Quartz Creek, Elk Creek, and Pony Creek. Bull trout are considered widespread throughout these subwatersheds, and it is assumed that bull trout occur in the areas between documented sightings. Both fluvial and resident life forms are believed to occur (USDA 2001 and Service 2002).

III. Environmental Baseline

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have already undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultations in progress. Such actions include, but are not limited to, previous timber harvests and other land management activities.

A. Status of the Species in the Action Area

Bull trout populations have been documented throughout the South Fork Salmon River watershed. Thurow (USDA 2001) documented the presence of both resident and fluvial stocks in all reaches and 18 tributaries that were surveyed. Fish densities for the mainstem and tributaries ranged from 0.26 to 0.51 fish per 100 square meter. Tributaries function as spawning and rearing areas for fluvial and resident stocks, and the mainstem South Fork Salmon River serves as a migration corridor and overwintering area for both emigrating juveniles and adult fish (USDA 2001).

Thurow (USDA 2001) documented that overall bull trout populations are viable in the South Fork Salmon River, however the status of discrete populations is unknown. Populations throughout the Upper Columbia River Basin have been affected by fishing pressures, water diversions, and habitat degradation (Fraley and Shepard 1989).

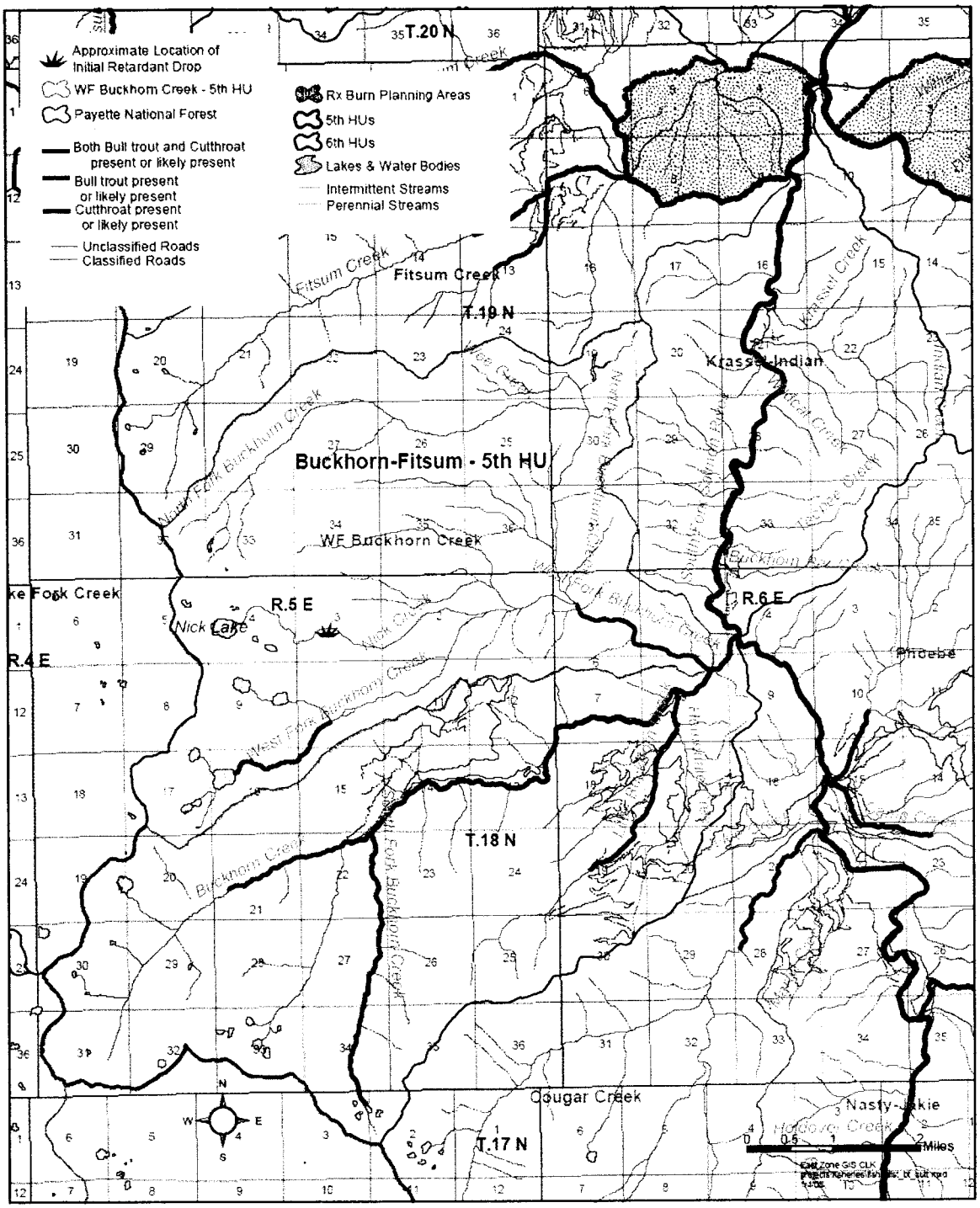
Bull trout are characterized as having three different life history patterns, resident, fluvial, and adfluvial. It is believed that all three life history phases are present in the South Fork Salmon River. In stream and lake resident populations, adults and juveniles occupy the same area throughout their lives. Many of these resident populations occupy cold, headwater streams. In fluvial and adfluvial populations, adults undergo extensive spawning migrations. Swanberg (1997) documented spawning migrations of 26 to 52 miles (42 to 84 km) for fluvial bull trout in a large river system. Smaller tributaries are used as spawning and rearing areas for juveniles. Fluvial and adfluvial populations may remain from one to six years in nursery streams before migrating downstream to rivers or lakes. As adults, they usually live in rivers or lakes for two to three years before spawning.

Bull trout spawn from late August through mid-October in the South Fork Salmon River and its tributaries. Length frequencies of bull trout observed by snorkeling in tributaries in 1984 and 1985 averaged as follows: 19 to 20 percent were less than 100 millimeters, 37 to 43 percent were from 100 to 200 millimeters, 21 to 34 percent were from 200 to 300 millimeters, six to eight

percent were from 300 to 400 millimeters, and two to10 percent were larger than 400 millimeters (USDA 2001). Annual growth increments of bull trout sampled in headwaters tributaries of the South Fork Salmon River in 1985 averaged 68 millimeters for the first year and declined to 42 and 45 millimeters the next two years. After the third year, average incremental growth increased to 63 and 67 millimeters. Increased growth after age three may reflect movement of some fish from tributaries into the mainstem South Fork Salmon River and Salmon River (USDA 2001). In the South Fork Salmon River, migration of bull trout probably begins in March or April as adults move slowly upriver and arrive near spawning areas in July. Large bull trout were observed staging in some South Fork Salmon river tributaries in August and September.

Bull trout were known to occur in the lower West Fork of Buckhorn Creek (Figure 2) in the early 1980s, but they were not observed in more recent surveys (1993 and 2004). Bull trout have not been observed in Nick Creek in recent surveys, but we have assumed that they are present throughout the action area for the purposes of this analysis.

Figure 2. West Fork of Buckhorn sixth hydrologic unit analysis area bull trout distribution for the Nick Fire retardant drop emergency consultation. (Map provided by the Payette National Forest).



B. Factors Affecting the Species and Its Habitat in the Action Area

The West Fork Buckhorn drainage consists of one 6th level hydrologic unit, covers about 14,531 acres, and enters the mainstem Buckhorn Creek about 0.5 mile upstream of the confluence of Buckhorn Creek and the South Fork Salmon River. Tributaries to the West Fork Buckhorn Creek include Nick Creek and North Fork Buckhorn Creek. The approximate discharge during late August 2004 of Nick Creek was 0.04 cubic meters/second, and of the West Fork Buckhorn Creek at the Nick Creek confluence was 0.06 cubic meters per second. The West Fork Buckhorn drainage is unroaded and accessed by a trail system.

A general conclusion is that the overall condition of the South Fork Salmon River watershed is improving due to the watershed rehabilitation actions implemented since the 1980's (USDA 2001). Natural events have occurred in the South Fork Salmon River in recent years that altered landscape characteristics, such as the 1994 fires and 1997 New Year floods. These events altered the watershed in terms of changes in plant succession, road washouts, stream crossing failures, erosion, and mass wasting. However, events such as these also have perpetuated ecosystem processes such as large woody debris recruitment to channels and riparian areas, channel sorting of substrate, and transportation of gravels downstream. Stream channels were altered by debris inputs, from the 1997 floods, for example. However, subsurface fine sediments have shown a continued declining trend, despite the flood-related alterations (Nelson et al. 1999)

Anthropogenic activities in the watershed include mining, timber/silviculture, grazing, road use agreements, special use permits, prescribed fire, habitat improvement projects, culvert replacements, and mine reclamation. In addition, fire and flood events caused extensive damage to human-caused characteristics such as roads.

C. Recent Section 7 Consultations

Effects from activities or projects that have already undergone section 7 consultation, as reported in a biological opinion, are an important component of objectively characterizing the current condition of the species. The Snake River Fish and Wildlife Office has completed one biological opinion for bull trout in the South Fork Salmon River Watershed since the year 1998. This project, entitled, "Addendum to the Biological Assessment for the Potential Effects of Managing the Payette National Forest in the South Fork Salmon River Section 7 Watershed, 2001- Fitsum-Dutch Oven Prescribed Burn and Lower Meadow Creek Relocation Projects" (OALS #1-4-04-F-466), applied to activities affecting bull trout in the East Fork of the South Fork Salmon River subwatershed, and addressed effects related to restoration actions at the Stibnite Mine Area.

Our analysis showed that the action consisted of only short-term adverse effects, but there were some long-term beneficial effects. It was determined that the action would not appreciably

reduce the likelihood of survival and recovery of the bull trout. Furthermore, the action was not expected to result in the loss of any subpopulations or local populations of bull trout. A more detailed analysis of consulted-on effects to bull trout is available in our files.

IV. Effects of the Federal Action

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the actions, that will be added to the environmental baseline" (50 CFR §402.02).

A. Direct and Indirect Effects

During fire suppression actions for the Nick Fire, approximately 300 to 600 gallons of Fire-Trol LCG retardant was directly delivered to Nick Creek. Fire-Trol is composed primarily of liquid ammonium polyphosphate and is based on commercial fertilizers. Hazardous decomposition products include ammonia and sodium cyanide. Studies have shown that a retardant drop directly into a stream may cause sufficient ammonia concentration in the water to be immediately lethal to fish and other aquatic organisms (Assessment). Aquatic toxicity of Fire-Trol LCG for rainbow trout is an LC50 value, Lethal Concentration that has been shown to kill 50 percent of the population, at 96 hours of 790 mg/liter.

The Assessment included reports from Forest Service chemist (Cece Johnson, Fire Chemical Project Leader, USDA, Missoula Montana) that the toxic effects of the cyanide component in the retardant, when exposed to ultraviolet (UV) light, may persist much longer than the effects of the ammonia. She indicated that retardant on riparian vegetation could be consistently washed into the aquatic environment for a long period of time, perhaps even into the next spring. Based on studies of effects of retardant on fishes with and without exposure to UV light (Ed Little, Wildland Fires with Chemical Products Workshop, May 2004), it is known that UV exposure significantly increases the toxicity of fire retardants containing ferrocyanide. Toxicity is likely to persist in treated areas and be released in rainwater runoff, and it is possible for the area of the retardant to recover, and then relapse as UV exposure increases.

Little et al (unpublished report) found that rainbow trout will actively avoid water contaminated with fire-retardant chemicals (including those in Fire-Trol). The authors believe that this is the primary response of organisms to unfavorable or hazardous environmental conditions. This adaptive behavior will reduce exposure to contaminants, and fish are less likely to take up residence in unfavorable or contaminated habitats. If retardant is consistently washed into Nick Creek from stream-side vegetation and exposure to UV light increases the toxicity, this avoidance behavior by bull trout and other native fishes could persist long after the retardant is believed to have washed downstream from the initial drop.

The Assessment also reports that a Fire-Trol chemist (Rob Crouch, Chemist, Fire-Trol Holdings LLC, Phoenix, AZ) was consulted to determine if fish and macroinvertebrates in Nick Creek could have been killed by the retardant drop, and how far downstream the concentration was likely to have lethal or sublethal effects to fish and macroinvertebrates. With specifics of the Nick Fire retardant drop, the chemist was certain that fish and macroinvertebrates were killed in

the immediate vicinity of the retardant drop due only to the ammonium compound. He estimated that fish and macroinvertebrates may have been killed or sublethally affected by the ammonium compound a mile or two downstream of the lowest drop point, but not four to five miles downstream (due to the ammonium compound), because ammonia dissipates rapidly in moving water and with dilution by incoming tributaries.

The Assessment also indicated that fish and macroinvertebrates that may have been present were likely killed at the site of the retardant drop and some distance downstream. Based on a schematic of the West Fork Buckhorn subwatershed, indicating tributary locations and likely dilution rates, Ed Little (USGS researcher) estimated that fish and macroinvertebrates would probably have been affected (lethally and sublethally) two miles downstream of the drop zone (at the confluence of Nick Creek and WF Buckhorn Creek). It was his opinion that fish and macroinvertebrates would possibly have been affected (lethally and sublethally) from the cyanide four to five miles downstream (at the mouth of West Fork Buckhorn Creek). It was also his opinion that fish would probably not have been affected (lethally and sublethally) in mainstem Buckhorn Creek due to the dilution factor. He estimated that lethal and/or sublethal effects would not persist beyond three years.

Although dead fish were not observed on the two reconnaissance visits that occurred after the retardant drop, it is reasonable to assume that there were lethal effects to all fish present within the retardant drop zone. Since bull trout were assumed to be present in West fork Buckhorn Creek, they were likely lethally affected by the retardant drop. Bull trout were also likely affected sub-lethally due to effects to macroinvertebrates (as food items for bull trout). The majority of the lethal effects were expected one time only, at the time of the retardant drop. Lethal effects to bull trout are possible for up to three years following the retardant drop, but are less likely. The sublethal effects described above are expected for a total of three years, with periods of recovery and relapse in stream habitat conditions.

Effects to habitat are also assumed up to five miles downstream from the drop zone for a three year period. The chemical contaminants and bull trout population (Local Population Size and Growth and Survival) watershed condition indicators were degraded as a result of the Federal action. Downstream of the confluence of Nick Creek and West Fork Buckhorn Creek, at Buckhorn Creek (five miles from the retardant drop), the effects to habitat are likely undetectable. Effects to other watershed condition indicators were not realized.

B. Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a 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. The Service is not aware of any actions occurring that are interrelated or interdependent to the Project.

V. 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 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 Service is unaware of any cumulative effects that may have occurred or that will occur in the future on adjacent state or private lands.

VI. Conclusion

After reviewing the current status of the Columbia River bull trout DPS, the environmental baseline for the species in the action area and the South Fork Salmon River watershed, the likely effects of the proposed actions, and cumulative effects, it is the Service's opinion that the Project, as implemented, was not likely to jeopardize the continued existence of the Columbia River distinct population segment of bull trout. The Service concludes that adverse effects to bull trout occurred as a result of implementation of the actions described in this Opinion, and we expect that they were great enough to appreciably reduce numbers in the West Fork Buckhorn subwatershed. However, we do not believe that bull trout numbers were appreciably reduced in the South Fork Salmon River watershed at large.

The Federal actions did not foreclose future opportunities for bull trout subpopulations to increase in size and distribution in the future, outside of the West Fork Buckhorn subwatershed. Implementation of the emergency actions by the Forest did not appreciably reduce the likelihood of either survival or recovery of bull trout, although for three years, recovery in the West Fork Buckhorn subwatershed of bull trout and macroinvertebrates (their primary food source) is uncertain. Lethal and sublethal effects did not appreciably reduce reproduction, numbers, or distribution of bull trout in the South Fork Salmon River Watershed.

VII. Incidental Take Statement

Section 9 of the Act and Federal regulation 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 by the Service 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 by the Service 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.

This consultation follows an emergency action. Therefore, any take that resulted from the fire suppression action occurred before the time of the Service's rendering its Biological Opinion. During the emergency response, the Forest consulted with the Service under the emergency procedures identified at 50 CFR 402.05 and implemented measures to minimize the effects of its

action. At this time, there are no further opportunities to reduce the effect of take that occurred incidental to the emergency response. In the following section, we provide a description of incidental take that likely resulted from the action but no Reasonable and Prudent Measures or Terms and Conditions are included in this Opinion.

A. Amount or Extent of Take

The inherent biological characteristics of aquatic species such as bull trout make observing death or harassment effects from the Nick Fire Suppression Activities difficult, but it is still necessary to quantify the take believed to have occurred. Take in the form of harm and harassment will be expressed in terms of time that retardant is believed to persist in the action area, where immediate impacts to bull trout are expected. Harm or harassment to any bull trout present during the action would occur through the disruption of feeding, spawning, and migratory behavior.

The Service believes that sublethal harassment effects on all individual bull trout present in the action area could persist for up to three years or through August 2007. Any actions outside of these time frames or beyond these bounds would be in excess of the incidental take assumed here. It is believed that all bull trout present in Nick Creek at the site of the retardant drop and five miles downstream to Buckhorn Creek were lethally taken as a result of the Nick Fire retardant drop.

B. Effect of the Take

The Columbia River DPS comprises 141 subpopulations of bull trout divided between four geographic areas. The Snake River geographic area contains 34 subpopulations. Two of these subpopulations are found in the Salmon River drainage. The South Fork Salmon River subpopulation contains at least 27 local populations, at least one of which may be located in the action area, Buckhorn Creek. Lethal take is expected to be confined to West Fork Buckhorn Creek. As noted in this Opinion, harm to habitat and harassment of fish likely occurred throughout the West Fork Buckhorn Creek 6th hydrologic unit drainage that constitute the action area. As we have stated, most of the effects from the action are expected to rise to the level of take. Also, effects are expected to extend for a total of three years given the potential persistence of Fire-Trol.

The probability that the Federal action will eliminate a significant portion of the Buckhorn Creek local populations of bull trout is highly likely. The effects are expected to be localized in the form of behavioral changes, habitat effects, and lethal take. The effects to breeding, feeding, including availability of prey, and movement are expected to significantly change population numbers, and local bull trout densities and distribution are expected to be significantly altered for a period of three years. As the analysis area contains one local population of bull trout among 125 (0.8 percent) local populations in the Salmon River watershed, it is unlikely that effects from the Project would impair productivity or population numbers of bull trout in the Salmon River watershed or in the Columbia DPS.

C. Reasonable and Prudent Measures/ Terms and Conditions

The incidental take statement in an emergency consultation does not include reasonable and prudent measures or terms and conditions to minimize take, unless the agency has an ongoing action related to the take of bull trout. From the Assessment provided, the Service is not aware of any ongoing action related to the take. If the Forest is, or may become involved in any ongoing activities related to these actions, reinitiation of formal consultation is required.

VIII. 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 an action on listed species or critical habitat, to help implement recovery programs, or to develop information. The Service provides the following conservation recommendations.

1. The Forest should continue monitoring the five miles of stream that were affected by the Nick Fire Retardant drop through 2007. Because it is likely that the stream will recover and then relapse as retardant washes off vegetation or is exposed to UV light, monitoring should continue even after stream recovery is observed.

2. In addition to surveys for aquatic organisms, Forest monitoring of the action area should include searches for algal blooms, unnatural vegetation growth as a result of ammonia supplementation, and noxious weed infestations.

3. The Forest should institute future processes to better insure Forest fire personnel understand conservation measures designed to reduce effects to resources through fire suppression activities before each fire season. This would ensure that all reasonable efforts would be put forth to adequately minimize or avoid adverse effects to listed species.

4. The Forest should consider limiting future activities and projects that may negatively affect watershed conditions in the West Fork Buckhorn subwatershed, such as mining, timber harvest, road construction, and other activities that may have the potential to affect the chemical and contaminants watershed condition indicator.

5. The Forest can work towards recovery of bull trout in the West Fork Buckhorn subwatershed, specifically to the local population affected by the subject project, by identifying potential habitat restoration opportunities and implementing these actions in the near-term.

6. The Service recognizes the survey efforts put forth by the Forest and encourages continued survey and monitoring work for bull trout populations and habitat in the South Fork Salmon River Watershed to help gain a better understanding of numbers, distribution, and habitat use.

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

IX. Reinitiation—Closing Statement

This concludes formal consultation for the effects of the Nick Fire Retardant Drop on bull trout. 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 maintained (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 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. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Literature Cited

Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by U.S. Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River Drainage upstream of the confluence of the Flathead River from the 1950's to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78-R-1, Helena, MT.

Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by US Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River Drainage upstream of the confluence of the Flathead River from the 1950's to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78R-1, Helena, Montana.

Boag, T.D. 1987. Food habits of bull char, Salvelinus confluentus, and rainbow trout, Salmo gairdneri, coexisting in a foothills stream in northern Alberta. Canadian Field Naturalist 101(1): 56-62.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Bonneau, J.L. and D.L. Scarnecchia. 1996. Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. Transactions of the American Fisheries Society 125: 628-630.

Brewin, P.A. and M.K. Brewin. 1997. Distribution maps for bull trout in Alberta. Pages 206-216 in Mackay, W.C., M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Buchanan, D. M. and S. V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 1-8 in Mackay, W.C., M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, Salvelinus confluentus (Suckley), from the American Northwest. California Fish and Game 64(3):139-174.

Clearwater Basin Bull Trout Technical Advisory Team (CBBTTAT). 1998. North Fork Clearwater River Basin Bull Trout Problem Assessment. Prepared for the State of Idaho by the CBBTTAT. May 1998.

Nelson, R.L., D.C. Burns, D.D. Newberry, and M. Faurot. 1999. Deposition of fine sediment in the south Fork Salmon River and Chamberlain Creek watersheds, Payette and Boise National Forests, Idaho. Report of sediment trends from core sampling, 1966-1998. Intragravel conditions in spawning areas. July 1999. PNF, McCall, Idaho.

Newton, J.A. and S. Pribyl. 1994. Bull trout population summary: Lower Deschutes River Subbasin. Oregon Department of Fish and Wildlife, The Dalles, Oregon.

Oliver, G.G. 1979. Fisheries investigations in tributaries of the Canadian portion of the Libby Reservoir. Fish and Wildlife Branch, Kootenay Region.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 in Howell, P. J. and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Quigley, T.M. and J.J. Arbelbide. 1997. An assessment of ecosystem components in the Interior Columbia Basin and portions of the Klamath and Great basins. Vol. III. 1174-1185pp.

Ratliff, D. E. and P. J. Howell. 1992. The Status of Bull Trout Populations in Oregon. Pages 10-17 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Rich, C.F., Jr. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M.S. thesis. Montana State University, Bozeman, Montana.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302, Intermountain Research Station, U.S. Department of Agriculture, Forest Service, Boise, Idaho. (Bull Trout - B58).

Rieman, B.E. and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124 (3):285-296.

Rieman, B.E. and J.D. McIntyre. 1996. Spatial and temporal variability in bull trout redd counts. North American Journal of Fisheries Management 16:132-141.

Rieman, B.E., D.C. Lee and R.F. Thurow. 1997. Distribution, status and likely future trends of bull trout within the Columbia River and Klamath basins.

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.H. Lachner, R.N. Lea and W.B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada.American Fisheries Society Special Publication 12, Bethesda, Maryland.

Donald, D.B. and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology 71:238-247.

Fraley, J.J. and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (Salvelinus confluentus) in the Flathead Lake and River system, Montana.Northwest Science 63(4):133-143.

Gilpin, M., University of California, in litt. 1997. Bull trout connectivity on the Clark Fork River.

Goetz, F. 1989. Biology of the bull trout, *Salvelinus confluentus*, a literature review. Willamette National Forest. Eugene, Oregon.

Goetz, F.A. 1994. Distribution and juvenile ecology of bull trout (Salvelinus confluentus) in the Cascade Mountains. M.S. Thesis, Oregon State University, Corvallis, OR.Goetz, F.A. 1994. Distribution and juvenile ecology of bull trout (Salvelinus confluentus) in the Cascade Mountains. M.S. Thesis, Oregon State University, Corvallis, Oregon.

Hoelscher, B. and T.C. Bjornn. 1989. Habitat, densities, and potential production of trout and char in Pend Oreille Lake tributaries. Job Completion Report, Project F-71-R-10, Subproject III, Job No. 8. Idaho Department of Fish and Game. Boise, Idaho.

Idaho Department of Fish and Game. 1995. List of stream extirpations for bull trout in Idaho.

Jakober, M. 1995. Autumn and winter movement and habitat use of resident bull trout and westslope cutthroat trout in Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

Leathe, S.A. and P. Graham. 1982. Flathead Lake fish food habits study. Environmental Protection Agency through Steering Committee for the Flathead River Basin Environmental Impact Study.

Light, J., L. Herger and M. Robinson. 1996. Upper Klamath Basin bull trout conservation strategy, a conceptual framework for recovery. Part One. The Klamath Basin Bull Trout Working Group.

Little, E.E., J.B. Wells, and R.D. Calfee. Behaviorial Avoidance/Attractance response of rainbow trout to fire-retardant chemicals. USDA Forest Service Final Report ECO-06. http://www.cerc.usgs.gov/pubs/center/pdfDocs/ECO-06.PDF

Meefe, G.K. and C.R. Carroll. 1994. Principles of conservation biology. Sinauer Associates, Inc. Sunderland, Massachusetts.

Nelson, R.L., D.C. Burns, D.D. Newberry, and M. Faurot. 1999. Deposition of fine sediment in the south Fork Salmon River and Chamberlain Creek watersheds, Payette and Boise National

Schill, D.J. 1992. River and stream investigations. Idaho Department of Fish and Game.

Sedell, J.R. and F.H. Everest. 1991. Historic changes in pool habitat for Columbia River Basin salmon under study for TES listing. Draft U.S. Department of Agriculture Report. Pacific Northwest Research Station, Corvallis, Oregon.

Sexauer, H.M. and P.W. James. 1997. Microhabitat use by juvenile trout in four streams located in the Eastern Cascades, Washington. Pages 361-370 in Mackay, W.C., M.K. Brown and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Shepard, B., K. Pratt, and P. Graham. 1984. Life Histories of westslope cutthroat and bull trout in the upper Flathead River Basin, Montana. EPA Contract No. R008225-01-5. Montana Department of Fish, Wildlife and Parks, Helena, Montana. 115pp.

Swanberg, T.R. 1997. Movements and Habitat Use by Fluvial Bull Trout in the Blackfoot River, Montana. Transactions of the American Fisheries Society 126:735-746.

Thomas, G. 1992. Status of bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.

U.S. Department of Agriculture (USDA). 2001. Biological assessment for the potential effects of managing the Payette National Forest in the South Fork Salmon River Section 7 watershed on Snake River spring/summer and fall chinook salmon and Snake River summer steelhead trout, Volume 24: Ongoing and new actions.

U.S. Fish and Wildlife Service (Service). 2002. Bull trout draft recovery plan Chapter 17, Salmon River Recovery Unit.

Washington Department of Fish and Wildlife. 1997. Washington State salmonid stock inventory. Bull trout/Dolly Varden. September 1997. 437pp.

Watson, G. and T. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: an investigation into hierarchical scales. North American Journal of Fisheries Management 17:237-252.

Ziller, J.S. 1992. Distribution and relative abundance of bull trout in the Sprague River subbasin, Oregon. Pages 18-29 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.