A Summary

and

Analysis of Data

pertaining to

Management Indicator Species

for the

Ouachita National Forest

November 24, 2008

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Chapter I: Introduction

Following passage of the National Forest Management Act (NFMA) in 1976, the Secretary of Agriculture, on the advice of the Committee of Scientists, promulgated regulations to guide the development of plans for the National Forest system (36 CFR 219). Among other things, for fish and wildlife resources, these regulations at 219.19(a)(1) state:

"In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as management indicator species and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities. In the selection of management indicator species, the following categories shall be represented where appropriate:

Endangered and threatened plant and animal species identified on State and Federal lists for the planning area;

Species with special habitat needs that may be influenced significantly by planned management programs;

Species commonly hunted, fished or trapped;

Non-game species of special interest; and

Following passage of the National Forest Management Act (NFMA) in 1976, the Secretary of Agriculture, on the advice of the Committee of Scientists, promulgated regulations to guide the development of plans for the National Forest system (36 CFR 219)(in effect before November 9, 2000). Among other things, for fish and wildlife resources, these regulations at 219.19(a)(1) state:

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Endangered and threatened plant and animal species identified on State and Federal lists for the planning area;

Species with special habitat needs that may be influenced significantly by planned management programs;

Species commonly hunted, fished or trapped;

Non-game species of special interest; and

Additional plant or animal species selected because their populations changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.”

Section 219.19(a)(6) requires that:

Population trends of the management indicator species will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with State fish and wildlife agencies to the extent practicable.

The Revised Land and Resource Management Plan for the Ouachita National Forest (USDA Forest Service, 2005a) defined the Ouachita National Forest list of Management Indicator Species, which includes14 stream fishes, 3 lake/pond fishes, and 7 terrestrial vertebrates. This document summarizes monitoring information for these species, and assesses their status and conservation. This document is not an end product. It may be updated at any time when results from continuing monitoring efforts become available or as significant new data become available.

Chapter II: Stream Fishes

For stream fishes, three data sources are readily available to the forest. Data sources include the Basin Area Streams Survey (BASS) and Long-term Stream Survey Records (L-TSSR) which include long-term stream monitoring efforts, and fish collection records from Dr. Henry W. Robison in Arkansas and Dr. William L. Fisher in Oklahoma.

The BASS inventory is a systematic classification of stream habitats and a collection of data within habitat units. Physical, chemical and biological data were collected to examine possible impacts of forest management on streams forestwide by ecoregion. This allows for a comparison of reference and managed watersheds by ecoregion. Reference streams are those with little human influence on or management activities within their watersheds, such as Wilderness or Research Areas. Managed streams are those that have roads, timber harvest, prescribed fire, wildlife stand improvement and various other activities conducted within their watersheds on National Forest (NF) Lands.

The Paired-Stream BASS inventories served a managed and a reference stream within ecoregions. The initial inventory was completed in 1990 and resurveyed in 1991, 1992, 1996, 2001 and 2006. Fish populations were sampled for 10% of each habitat with an electrofishing unit using a depletion sampling method with a minimum of three passes. Fish were identified, measured, counted within 5mm size classes, and weighed. Retained specimens were curated in the Zoology Museum at Northeastern Louisiana University. A description of the BASS methodology is found in Appendix A. A complete description of the study areas, methods and results of these surveys can be found in USDA Forest Service, Ouachita National Forest (1994).

Long-term Stream Survey Records (L-TSSR) conducted by the Forest utilized a modification of the Basin Area Stream Survey (BASS) methodology (Clingenpeel and Cochran 1992) to collect biological and physical water quality data. Appendix B gives a description of the methodology. The objectives of this monitoring effort are: to collect baseline fish data, to observe water quality variables at the sites through time, to determine if these physical and biological variables fall within the range of natural variability, and to monitor management indicator species (MIS) population trends. In watersheds planned for timber harvest activity, another objective is to monitor the effects of management activities on stream integrity.

The L-TSSR includes over 130 samples from 18 monitoring sites that have been established within the Ouachita National Forest since 1995. These sites lie primarily within the Ouachita Mountain ecoregions where most of the Forest System Lands and many of the threatened, endangered and sensitive fish species within the Ouachita National Forest are known to occur. In most cases, these monitoring sites have been sampled annually. The Robison and Fisher samples are primarily stream fish samples with species lists that indicate relative abundance of each species.

Stream systems are dynamic and thus result in a natural range of variability in regard to physical, chemical and biological factors. Fish community structure changes through time based on such factors as habitat and food availability, predation, disease, stream flow and climatic conditions. These factors may or may not be related to anthropogenic activities. For example, the current multiple-year drought has likely had a dominating influence on fish population dynamics in Ouachita Mountain streams, particularly streams that receive little groundwater influence.

Drought tends to diminish stream flow, which in turn influences such factors as habitat availability, predation, competition and disease. Watershed land use influences can complicate natural interactions, and it is often very difficult to separate these different influences in the form of direct cause and effect relationships.

Useful aspects of population dynamics include percent site occurrences (number of sample sites in which a species occurs) through time and mean densities (number of fish per unit of sampling time or area) within a stream reach over time. BASS survey data can be used to formulate population estimates by reviewing percent site occurrence for a species and then by comparing the range of population densities where that species was collected. These methods allow population estimates to be made for each species by stream, ecosystem and year. These estimates can be plotted to represent estimated population fluctuations through time. Comparisons of population dynamics can also be made between managed and reference streams.

Samples from L-TSSR sites are not as intensive or comprehensive as BASS sampling. However, more sites can be examined throughout the Forest by surveying representative stream reaches. Stream population estimates cannot be made using the L-TSSR data, but population dynamics at representative sites can be observed through time. This type stream survey has often been implemented prior to and used when forest management activities are being performed in the watershed. It has also been used to assess biotic integrity at sites above and below obvious sources of impact, such as ATV trails or road crossings. From these data percent occurrence, density and catch per unit effort were calculated.

When data from the BASS inventories, L-TSSR or other surveys were unavailable for a species, the Robison and Fisher databases were used for this report. These databases include collections of fish samples from across Arkansas and Eastern Oklahoma, as well as from numerous studies and researchers over a number of years. Unfortunately, these collections include a wide variety of methods and data integrity, limiting comparisons between databases.

Methodologies

Population levels were determined for each Management Indicator Species. When data were available from the BASS inventories, the first step was to determine the number of samples where the species occurred. The number of sample/species was then compared to the total number of samples for that stream for each year to obtain a percent site occurrence. Percent site occurrences were used as one means by which to characterize populations and to observe population dynamics through time.

The next step was to determine population densities from the samples where the species was collected during the BASS inventories. This allows for a direct comparison of managed and reference streams over time, and by ecoregion. Populations were normalized by stream habitat length (number of fish per 100 meters). When the sample size was adequate (five to seven samples) the data were displayed in a box-whisker plot for an easy comparison of reference and managed streams. This display represents the range of population levels where the median is shown in the middle of the box, the extent of the box represents 25% and 75% of the population, and the whiskers (lines) represent 10% and 90% of the population levels. This allows for three levels of analysis. The first level is a comparison of reference and managed populations for all years regardless of ecoregion. The second level is the comparison of reference and managed populations for all years by ecoregion. The third level is the comparison of reference and managed populations by year and ecoregion.

The third step in characterizing populations was to examine data from L-TSSR within the same ecoregion, and to make comparisons or inferences from those data when possible. When data from the BASS inventories or L-TSSR were unavailable for a species, the Robison and Fisher databases were queried for occurrences in or around the Ouachita National Forest. Using fifth-level watersheds (40,000 to 250,000 acres) the occurrence and numbers of a species can be discussed and general inferences can be made regarding population dynamics.

Following is a discussion of each MIS, the existing data sources, the identification of population trends, and an interpretation of the effects of management activities on populations. The species are separated by ecoregion as they were originally documented in the ALRMP. However, if the species was inventoried outside that ecoregion, that information is included as well.

The initial MIS listed species by Ecoregions as determined by Omernik (ADPC&E, 1986) and the Forest fell into three general zones (Arkansas River Valley, Ouachita Mountain and Gulf Coastal Plan).   One early result of monitoring and inventories efforts was the determination that these ecoregions were too coarse to characterize the effects of management activities. The Forest modified Omernik and Bailey's ecoregions such that there are three ecoregions associated with the main block of the Forest. Throughout the text these ecoregions are referred to as the Arkansas River Valley (ARV), Upper Ouachita Mountain (UOM) and Lower Ouachita Mountain (LOM) ecoregions. Figure 2.1 displays the original and the modified ecoregions.

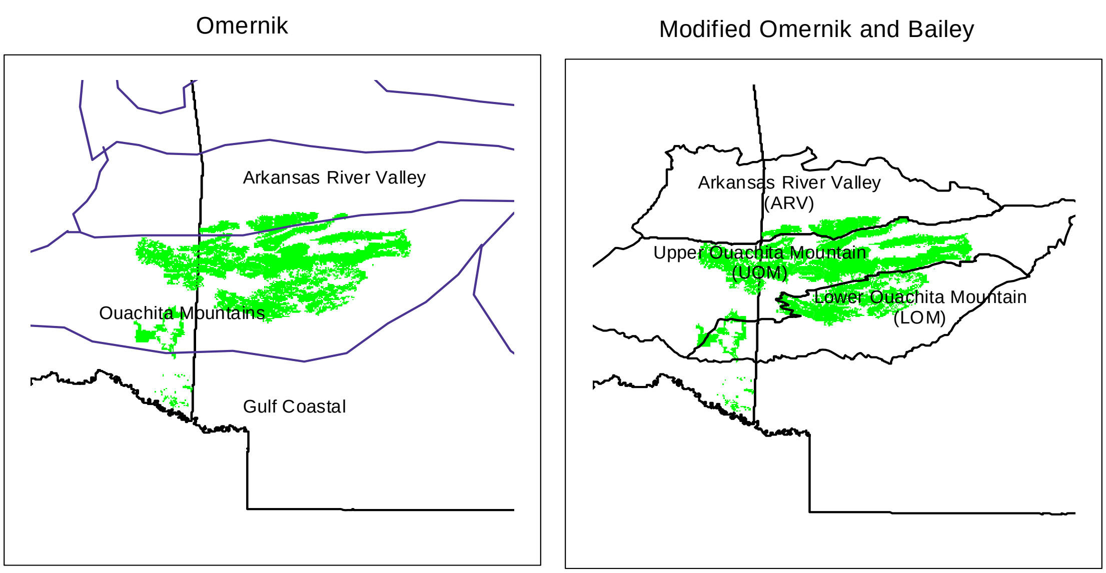

Figure 2.1—Aquatic ecoregions as they are applied to the Ouachita National Forest.

Yellow bullhead (*Ictalurus natalis*)

The yellow bullhead is native throughout most of the eastern and central U.S. and southern Canada and is common in Arkansas reservoirs. It is also found in a variety of river and stream habitats, but seems to prefer the gravel/cobble substrates of clear permanent streams. It avoids strong current and is found to occur primarily in pools with structure (root wads, undercut banks, boulders, etc.). Feeding habits may be somewhat more specialized than in the other bullhead species, with insect larvae, mollusks, crustaceans and small fish preferred. The yellow bullhead is considered a key species by the Arkansas Department of Environmental Quality for the Arkansas River Valley Ecoregion (ARV). It has rarely been collected in smaller streams within the ARV ecoregion of the Ouachita National Forest.

Data Source: Yellow bullheads were collected in five of six BASS streams: Jack Creek (Managed ARV), South Alum Creek (Reference UOM), Bread Creek (Managed UOM), Brushy Creek (Managed LOM) and Caney Creek (Reference LOM). Within the L-TSSR, yellow bullheads were found in 77 of 106 collections within the Ouachita Mountain ecoregions of the Forest between 1996 and 2007.

From the Robison data, yellow bullheads were found in 110 collections representing 79 sites. These sites represent 25 of the 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data included 152 collections from 135 sites. These sites represent 16 of the 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: The number of collections with yellow bullheads from Jack, South Alum and Bread Creeks was of insufficient size to determine trends. The percent occurrence of yellow bullhead samples for Brushy and Caney Creeks is presented in Table 2.1. Brushy and Caney Creeks both had a decline in percent occurrence over time although Caney Creek showed a sharp increase in 2006. Continued monitoring efforts will either support this as a trend or prove it to be an anomaly. In comparing Brushy Creek to Caney Creek, Brushy Creek initially had higher percent occurrences than Caney Creek through 1992.

From 1996 through 2006, yellow bullhead median densities have declined to similar or slightly lower levels for managed streams (Brushy Creek). Figure 2.2 displays population densities for yellow bullhead in the LOM ecoregion.

Table 2.1—Percent site occurrence of yellow bullhead by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Brushy (Managed, LOM)	85.2	75.9	60.0	34.4	46.9	40.0
Caney (Reference, LOM)	67.5	54.0	41.7	39.3	41.1	83.3

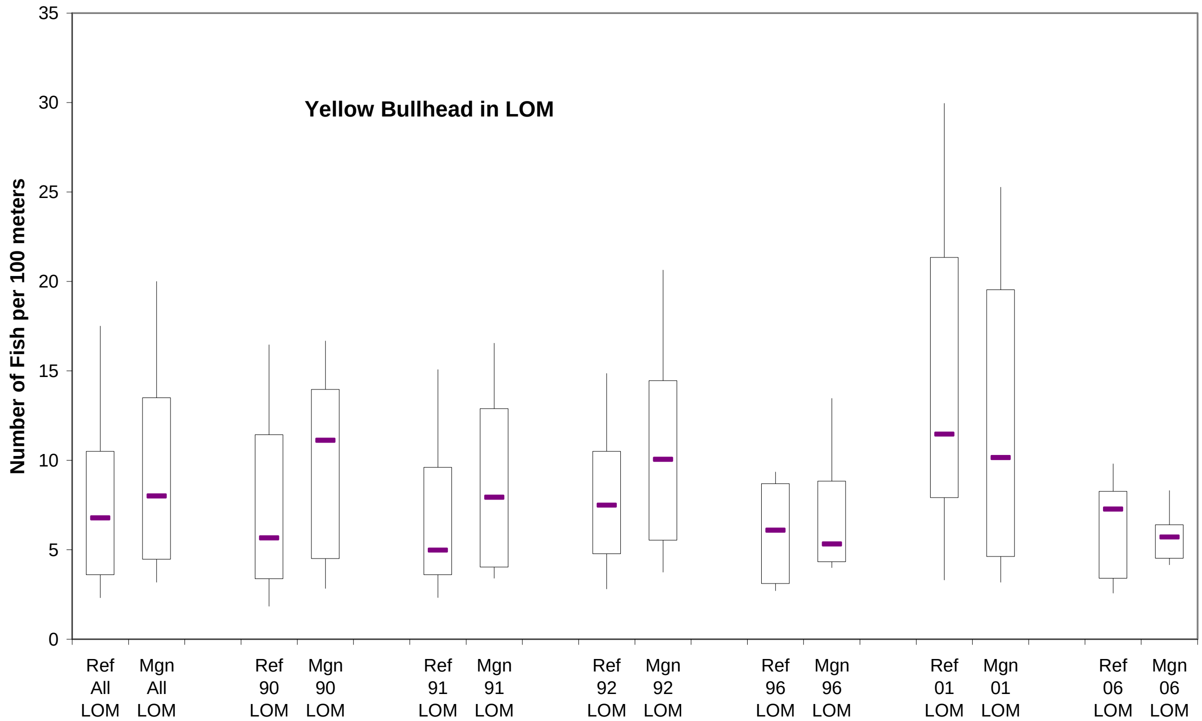

Figure 2.2—Yellow bullhead densities in BASS samples, LOM.

For comparison Table 2.2 shows the percent occurrence by ecoregion from L-TSSR. Table 2.3 and Figure 2.3 show population densities for L-TSSR. To aid in the interpretation of the figure, zero results are displayed in the figure as a negative.

Table 2.2—Percent occurrence of yellow bullhead from L-TSSR

Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
LOM	60	50	60	67	100	20	100	57	80	73	50	44
UOM	0	83	100	60	100	100	67	67	100	67	50	46

Table 2.3—Number of yellow bullhead per 100 meters from L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cossatot	LOM	7.5	18.2	13.4	0	ns	ns	2.9	0	ns	0	0	4.5
Shirley Creek	LOM	1.1	0	1.2	0	ns	ns	ns	0	ns	0	0	0
Irons Fork	UOM	ns	9.6	3.8	2.6	ns	0.9	2.8	8.2	3.9	0.9	2.1	1.9
Muddy Creek	UOM	ns	2.1	3.3	3.3	3.2	ns	7.5	6.8	ns	1.1	1.0	1.1

ns = not sampled

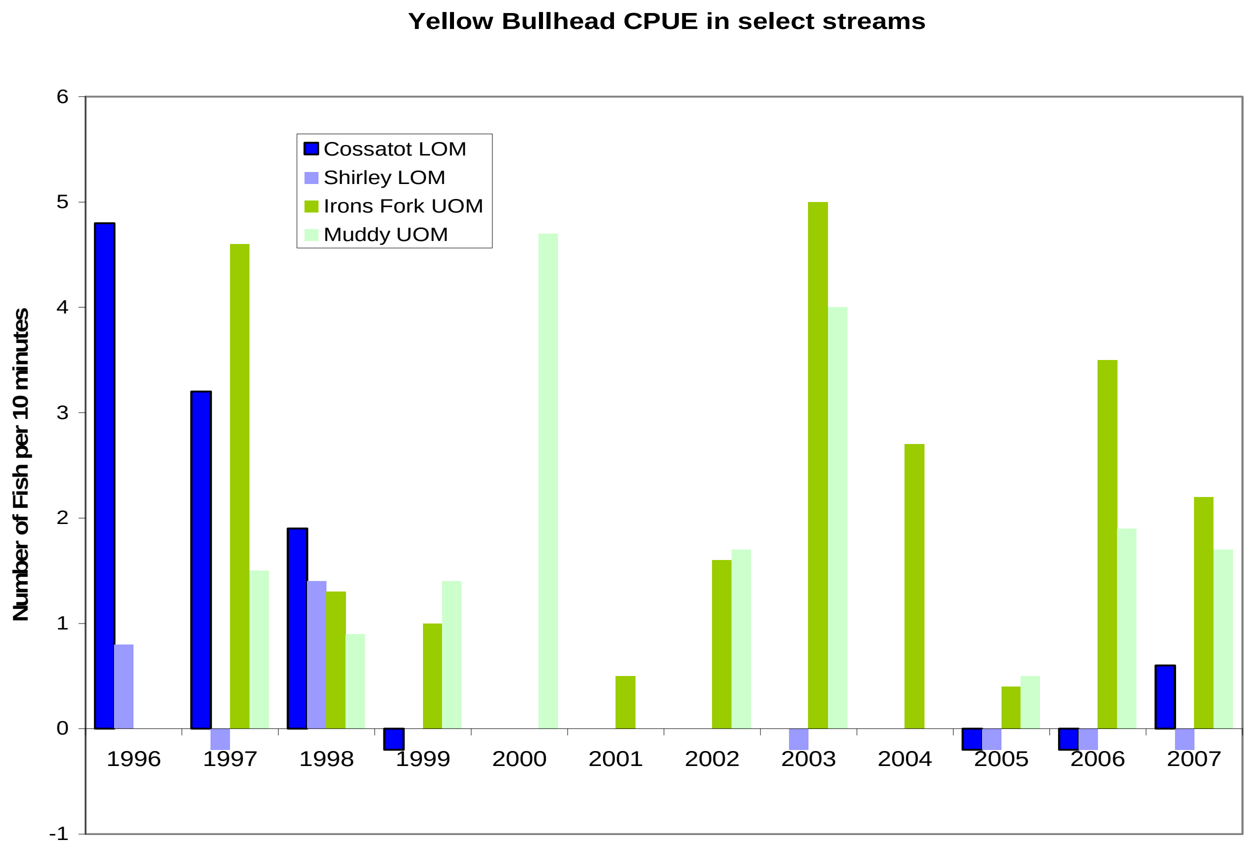

Figure 2.3—Catch per unit effort for yellow bullhead at L-TSSR within the UOM and LOM ecoregions.

Interpretation of Trends: Insufficient information is available to determine percent occurrence trends for the ARV or the UOM ecoregions. Initially from the percent occurrence there appears to be a higher occurrence of yellow bullhead in managed streams than in reference streams in the LOM ecoregion (1990-1992). In addition, there was a decline in the number of occurrences over time for both streams until 2001. Comparisons of population densities suggest that managed streams have a decreasing population density in comparison to reference streams.

The L-TSSR sites have shown a high percent site occurrence of this species through time in the LOM and UOM ecoregions. Population densities for 16 of the 27 sites where it occurred, fell within the natural range of variability, however there appears to be a declining trend within the LOM. Catch per unit effort (CPUE) values show a rapid decline in LOM streams from 1996-2007.

Consequences for Conservation of the Species: Yellow bullheads are common throughout much of the LOM. Species occurrence numbers indicate a declining trend at BASS sites, as well as the L-TSSR sites. If forest management was comparable to the early 1990's, it is unlikely that there will be a long-term or permanent decline of this species. However, the Forest has seen a large increase in unmanaged recreation (OHV use) in conjunction with declines in road and trail maintenance.

Implications for Management: Figure 2.2 demonstrates the natural range of variability for population density for streams in the LOM. The distributions between BASS managed and reference streams for all years combined and individual years are similar but the data suggest a decline in population occurrence and densities in managed streams over time. The implications for management are significant given proposed increases in OHV use and the Forest's inability to conduct adequate road and trail maintenance due to lack of funding.

Longear sunfish (*Lepomis megalotis*)

The longear sunfish is native to much of the central and eastern U.S., including Texas northeast to New York, west to Minnesota, and south to Louisiana, Mississippi and Alabama. In Oklahoma and Arkansas, it occurs in a variety of habitats but is most abundant in small, clear, upland streams with rocky bottoms and permanent or semi-permanent flow (Miller and Robison 1973; Robison and Buchanan 1988). It avoids strong current, turbid water, and silt substrate. In the Ouachita National Forest, collection data indicate that it occurs in greatest abundance in the LOM, where streams are generally characterized by permanent flow, rocky substrate, and low turbidity. It decreases in abundance in the UOM and ARV ecoregions.

Data Source: Data sources include the BASS inventories and 124 of 131 L-TSSR samples (18 sites) across the forest. The Robison data had 577 collections at 241 sites. These sites represented 38 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data had 548 collections at 248 sites. These sites represented 14 of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: Longear sunfish are common throughout much of the UOM and LOM ecoregions. The percent site occurrence in the ARV was limited to Jack Creek (Reference). In the UOM ecoregion, South Alum Creek (Reference) had a higher percentage occurrence from 1990 through 1992, and Bread Creek had a higher percent occurrence from 1996 through 2006. Brushy Creek (Managed) had a slightly higher percent occurrence in the LOM ecoregion for all years except 2006 (Table 2.4).

Table 2.4—Percent site occurrence of longear sunfish by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Jack (Managed, ARV)	7.7	28.6	37.5	38.9	47.1	44.4
Dry (Reference, ARV)	0.0	0.0	0.0	0.0	0.0	0
Bread Creek (Managed, UOM)	28.6	42.9	45.5	59.1	47.1	75
South Alum Creek (Reference, UOM)	33.3	50.0	68.2	23.8	43.5	28.6
Brushy Creek (Managed, LOM)	66.7	34.5	50.0	40.6	66.7	55
Caney Creek (Reference, LOM)	55.0	30.0	37.5	32.1	61.3	66.7

A comparison of population densities for longear sunfish in the UOM ecoregion for all years and individual years shows that managed streams and reference streams have similar population densities for all years except for 1991 and 2006 (Figure 2.4). Median population densities in the BASS LOM ecoregion were similar (Figure 2.5).

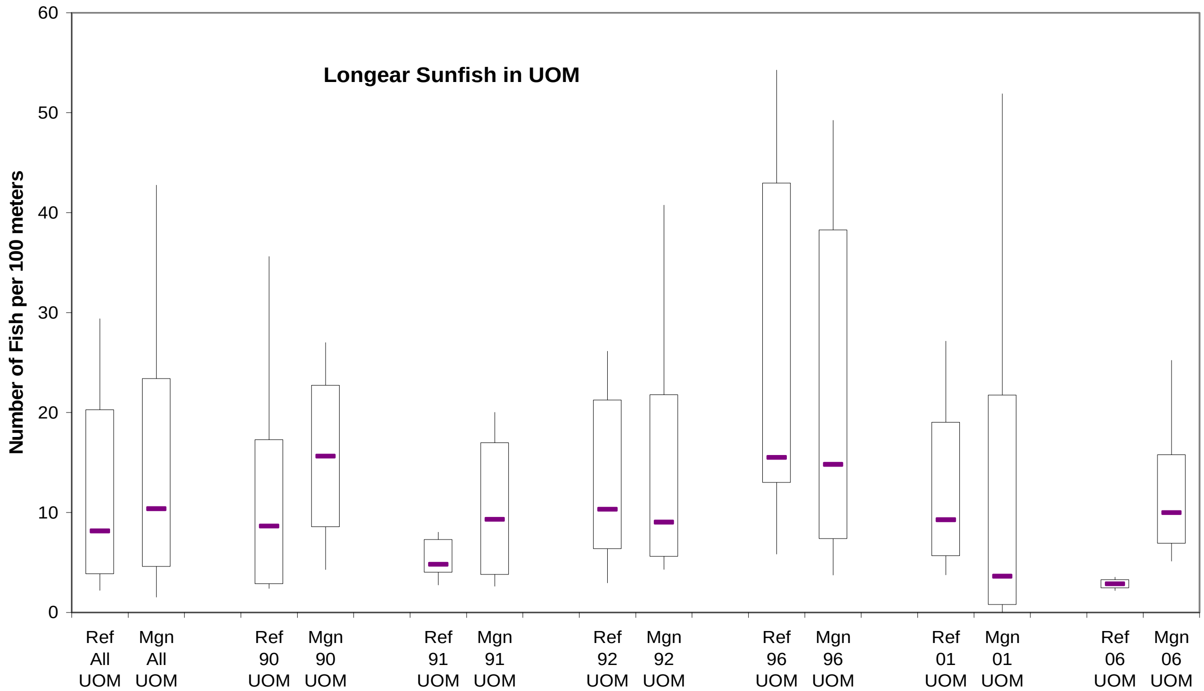

Figure 2.4—Longear sunfish densities in BASS samples, UOM.

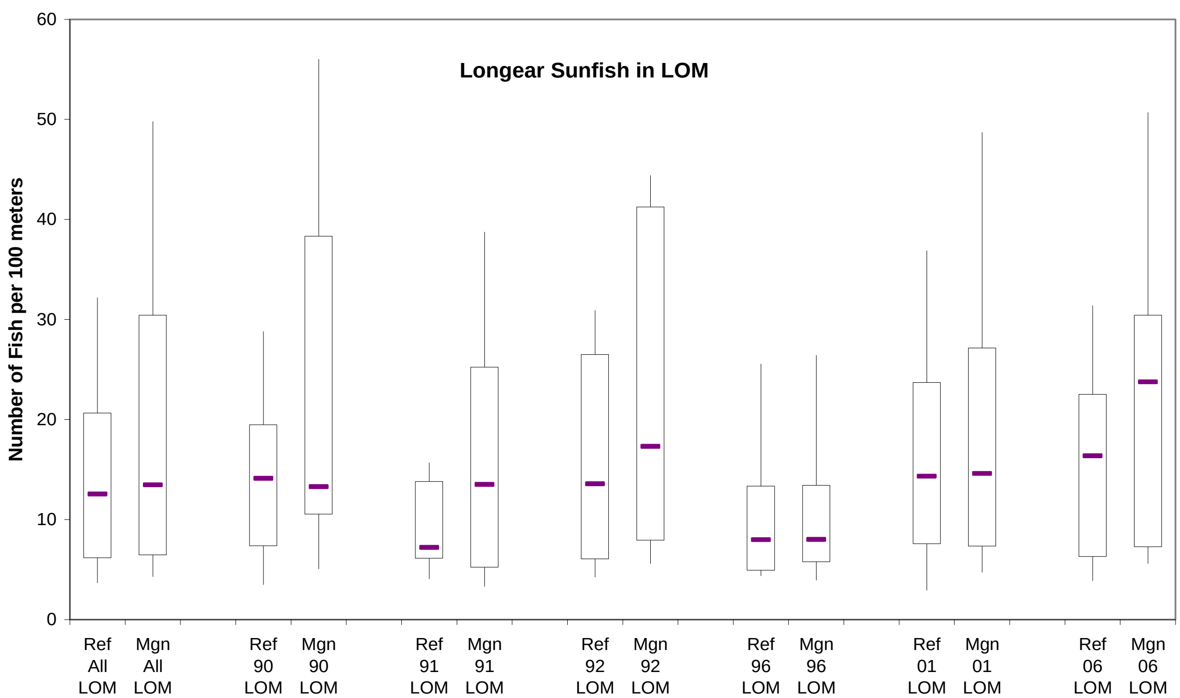

Figure 2.5—Longear sunfish densities in BASS samples, LOM.

From L-TSSR samples, average annual densities ranged from 15.3 fish per 100 meters in 2001, up to 44.0 fish per 100 meters in 1997 (Figure 2.6). Streams were second to third order in size. Densities of longear sunfish are typically greater in third order or medium-sized streams than in smaller streams.

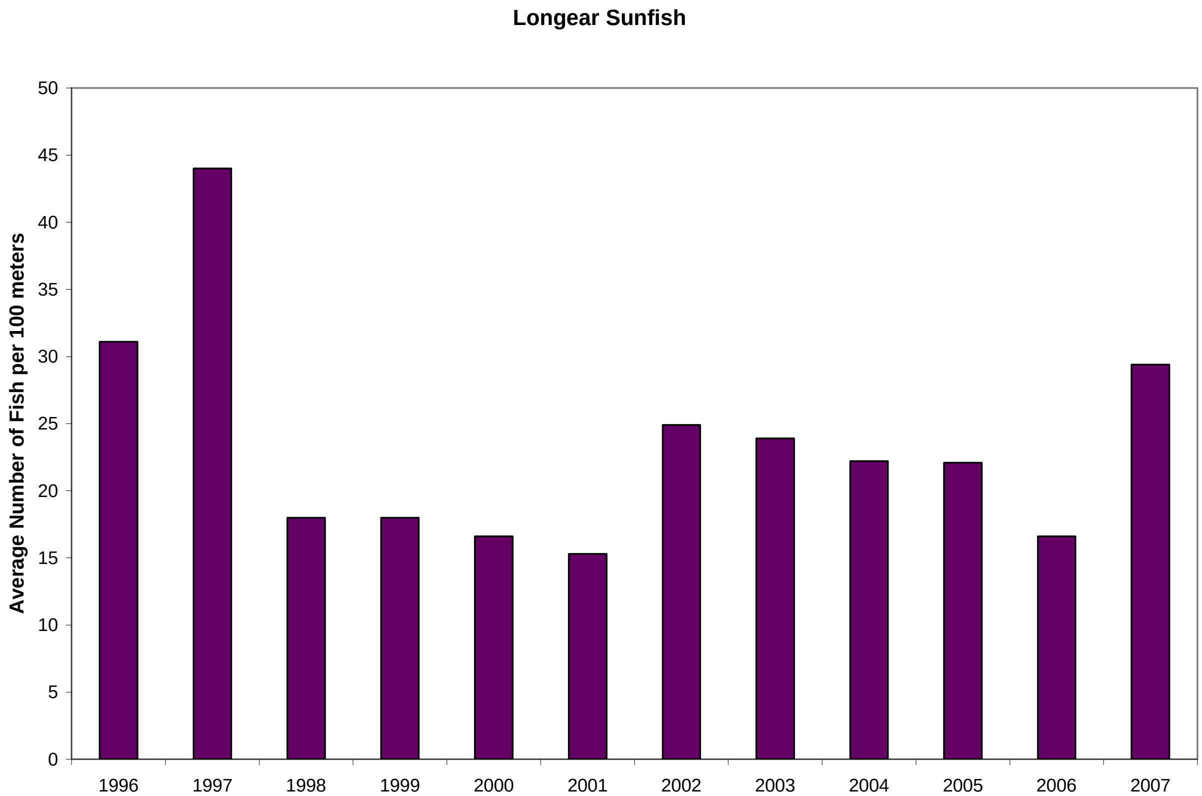

Figure 2.6—Average densities of longear sunfish collected from L-TSSR.

It appears that while populations of longear sunfish fluctuate from year to year, populations appear to be stable over time.

Interpretation of Trends: Percent site occurrence and population densities indicate that managed streams and reference streams are similar.

Consequences for Conservation of the Species: Longear sunfish are commonly distributed throughout much of the UOM and LOM ecoregions. The conservation status of this species across these ecoregions is good.

Implications for Management: Based on BASS and L-TSSR, there appears to be no adverse effect on longear sunfish populations from forest management activities.

Green sunfish (*Lepomis cyanellus*)

This species is native to most of the central and eastern U.S. west of the Appalachians and east of the Continental Divide, from the Great Lakes region south to the Gulf Coast states and northeastern Mexico. It has been introduced widely elsewhere in the United States and is generally common to abundant (Natureserve, 2001).

The green sunfish is an adaptable species that occurs in a variety of aquatic habitats, and is tolerant of a wide range of ecological conditions, particularly to extremes of turbidity, dissolved oxygen, temperature, and flow (Robison and Buchanan, 1988). In the Midwest the relative abundance of green sunfish increases in degraded streams (Karr et al. 1986). Data from the Ouachita Mountain ecoregions support that premise (Hlass et al. 1998). As opposed to the longear sunfish, Ouachita National Forest BASS collection data indicate that the green sunfish occurs in greatest abundance in the UOM and ARV, and decreases in abundance in the LOM where flow and water quality conditions are typically higher. Population increases of the green sunfish in forest streams could be an indicator of negative impacts from forest management activities.

Data Source: Data sources include the BASS inventories and 86 of 131 samples (18 sites) from L-TSSR. The Robison data had 297 collections at 122 sites. These sites represented 31 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data had 459 collections in 257 sites. These sites represented 19 of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: Green sunfish are found throughout much of the Ouachita National Forest. The percent site occurrence in the ARV was higher in Dry Creek (Reference) for four of six years, and South Alum Creek (Reference) was higher in the UOM for five of six years (Table 2.5). Percent site occurrence in the LOM was generally lower than the ARV and UOM paired streams; however in contrast, Brushy Creek (Managed) had a greater occurrence than Caney Creek (Reference) for all six years (Table 2.5).

Table 2.5—Percent site occurrence of green sunfish by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Jack (Managed, ARV)	23.1	23.8	56.3	38.9	35.3	44.4
Dry (Reference, ARV)	50.0	20.0	50.0	54.5	85.7	100
Bread Creek (Managed, UOM)	28.6	28.6	36.4	27.3	41.2	75.0
South Alum Creek (Reference, UOM)	66.7	16.7	68.2	47.6	47.8	85.7
Brushy Creek (Managed, LOM)	51.9	17.2	20.0	9.4	14.3	10.0
Caney Creek (Reference, LOM)	2.5	8.0	12.5	0.0	0.0	0.0

A comparison of population densities for green sunfish across all ecoregions for all years shows that managed streams and reference streams have similar population densities for all ecoregions except for the LOM (Figure 2.7). Population densities for the UOM are similar for managed and reference streams with the exception of 2001 (Figure 2.8). The occurrence of green sunfish is too low for a comparison of population densities by year for the ARV and LOM ecoregions.

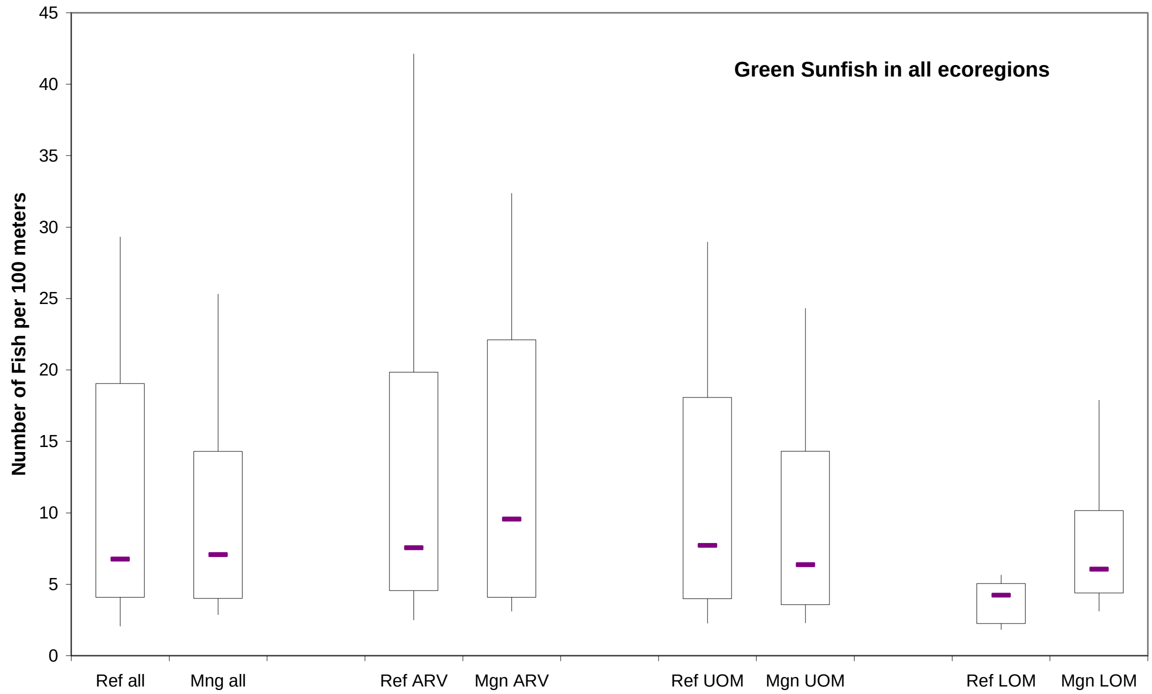

Figure 2.7—Green sunfish densities in BASS samples, All Ecoregions.

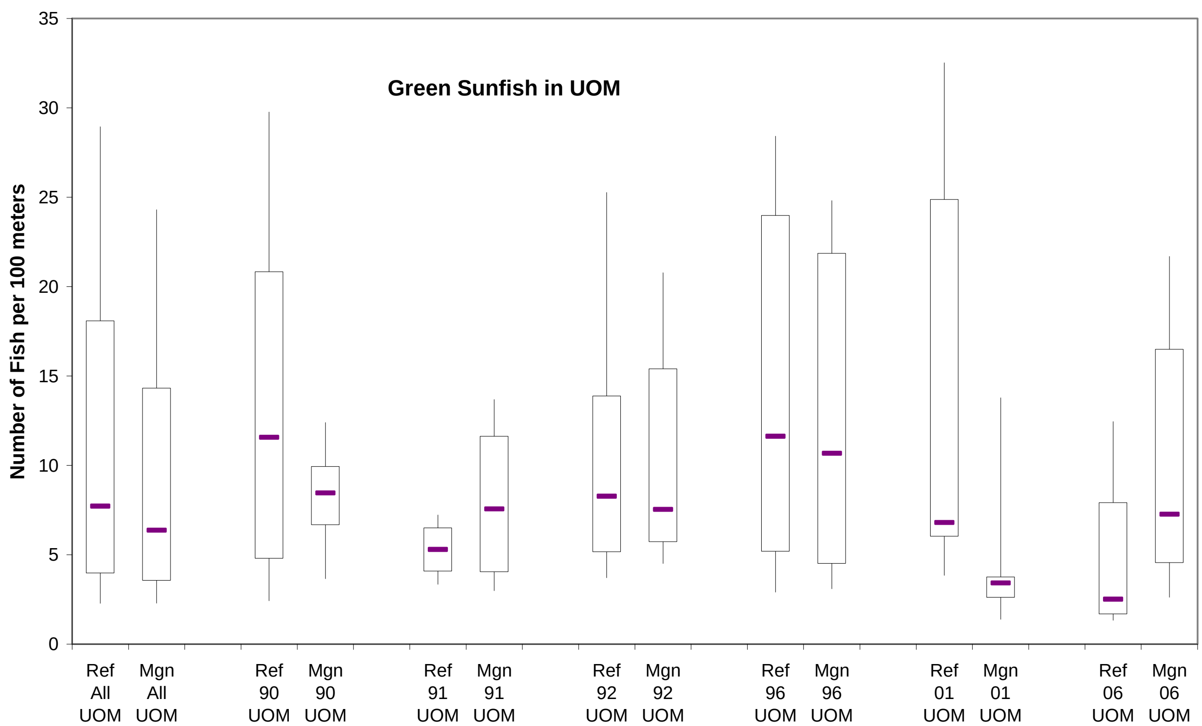

Figure 2.8—Green sunfish densities in BASS samples, UOM Ecoregion.

Average annual densities from L-TSSR ranged from 1.2 fish per 100 meters in 2001 up to 21.2 fish per 100 meters in 1997 (Figure 2.9).

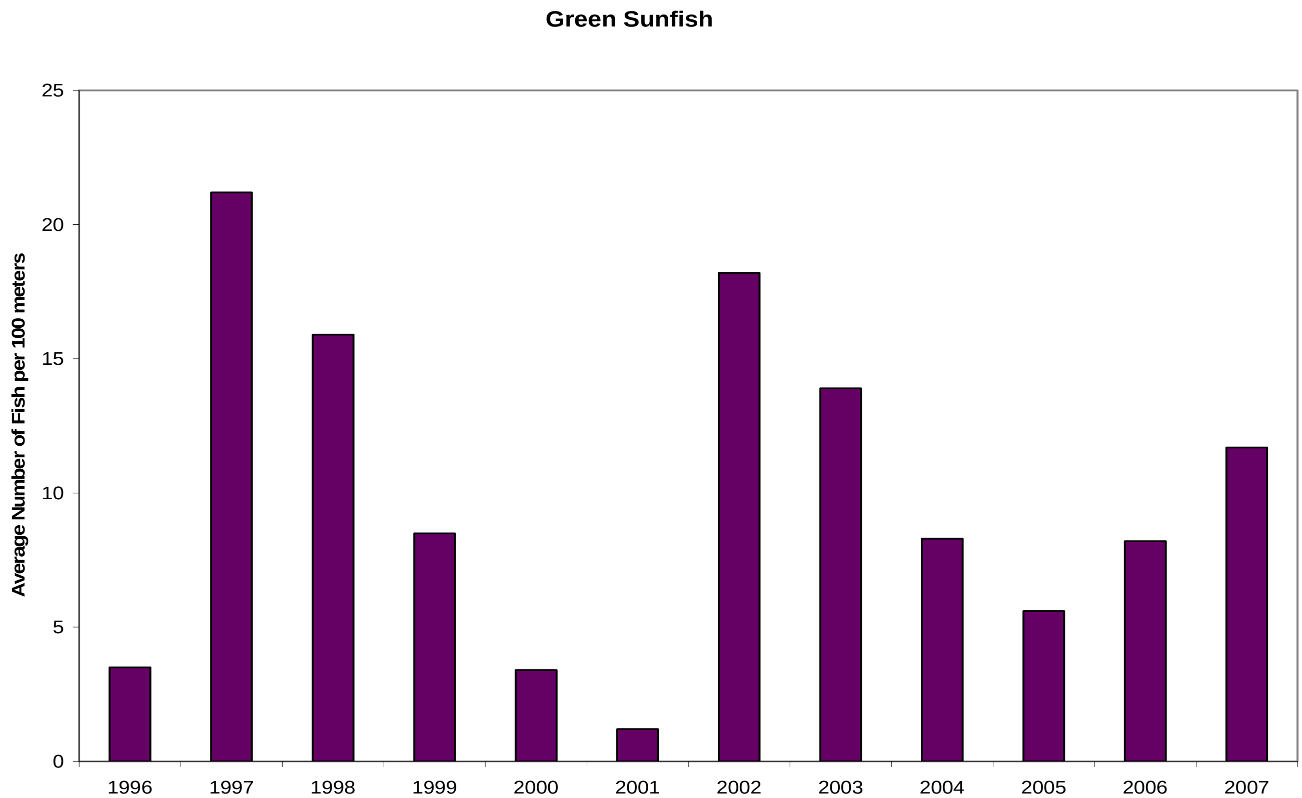

Figure 2.9—Average number of green sunfish collected from L-TSSR.

Population Trends: It appears that populations of green sunfish fluctuate from year to year. Many factors, biotic and abiotic, natural and anthropogenic, contribute to these fluctuations. Populations of green sunfish appear to be stable over time.

Interpretation of Trends: Percent site occurrence and population densities indicate that managed streams and reference streams are similar for green sunfish with the exception of the LOM. There are no indications that green sunfish are increasing as a result of management in the ARV or UOM. However the percent occurrence of green sunfish in Brushy Creek (Managed LOM) compared to the lack of occurrence in Caney Creek (Reference LOM) suggests that activities occurring on the forest are detrimentally impacting the aquatic habitat allowing for conditions that favor this very tolerant species within the LOM.

Consequences for Conservation of the Species: Green sunfish are commonly distributed throughout much of the ARV and UOM ecoregions and to a lesser degree the LOM ecoregion. The conservation of this species across this ecoregion is not in question.

Implications for Management: Based on BASS and L-TSSR, there appears to be no adverse effect on green sunfish populations as a result of forest management activities. However the percent occurrences within the LOM in managed streams suggest that the implications for management are potentially adverse given proposed increases in OHV (managed and otherwise) use and the inability to conduct road and trail maintenance in the LOM.

Central Stoneroller (*Campostoma anomalum*)

The central stoneroller occurs throughout much of the eastern and central U.S. from New York west to North Dakota and Wyoming, and south to South Carolina and Texas. Isolated populations occur in southwestern Mississippi and eastern Louisiana. It is common to abundant throughout much of its range (NatureServe 2001). Central stonerollers generally inhabit small to medium streams with cool, clear water, and gravel, cobble or exposed bedrock substrates. They are sometimes found in upland impoundments and in slow-moving, turbid water (Robison and Buchanan, 1998; NatureServe 2001). The cartilaginous lip of the lower jaw is used to scrape algae from rocks, thus this species can have a conspicuous effect on the distribution of algae in small streams (Matthews et al. 1987). Central stonerollers usually occur in large schools, especially in areas with few or no predators. Stream alterations that result in shallow homogenous habitats are conducive to increased central stoneroller populations (Ebert and Filipek 1988) because of both increased algal growth and decreased predation.

Data Source: Data sources include the BASS inventories and 129 of 131 samples (18 sites) from L-TSSR. The Robison data had 716 collections at 283 sites. These sites represented 38 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data had 370 collections in 227 sites. These sites represented 19 of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: Central stonerollers are common across the forest. The BASS data indicate that percent site occurrence was generally high across all streams and stayed fairly consistent throughout the years (Table 2.6).

Table 2.6—Percent site occurrence of central stonerollers by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Jack (Managed, ARV)	76.9	90.5	87.5	100.0	88.2	100.0
Dry (Reference, ARV)	100.0	100.0	87.5	100.0	100.0	100.0
Bread Creek (Managed, UOM)	28.6	28.6	59.1	18.2	35.3	87.5
South Alum Creek (Reference, UOM)	40.0	8.3	40.9	33.3	21.7	28.6
Brushy Creek (Managed, LOM)	92.6	72.4	80.0	75.0	85.7	90.0
Caney Creek (Reference, LOM)	92.5	82.0	85.4	75.0	87.1	94.4

A comparison of population densities for central stonerollers for all years and ecoregions show little difference between managed and reference steams (Figure 2.10). Figure 2.11 shows the wide range of population densities that can be found among years in the ARV. The UOM displays similar densities except for 1991 and 2006 (Figure 2.12). Densities in the LOM for all years and individual years' shows that managed streams had higher population densities for all years except for 1992 (Figure 2.13).

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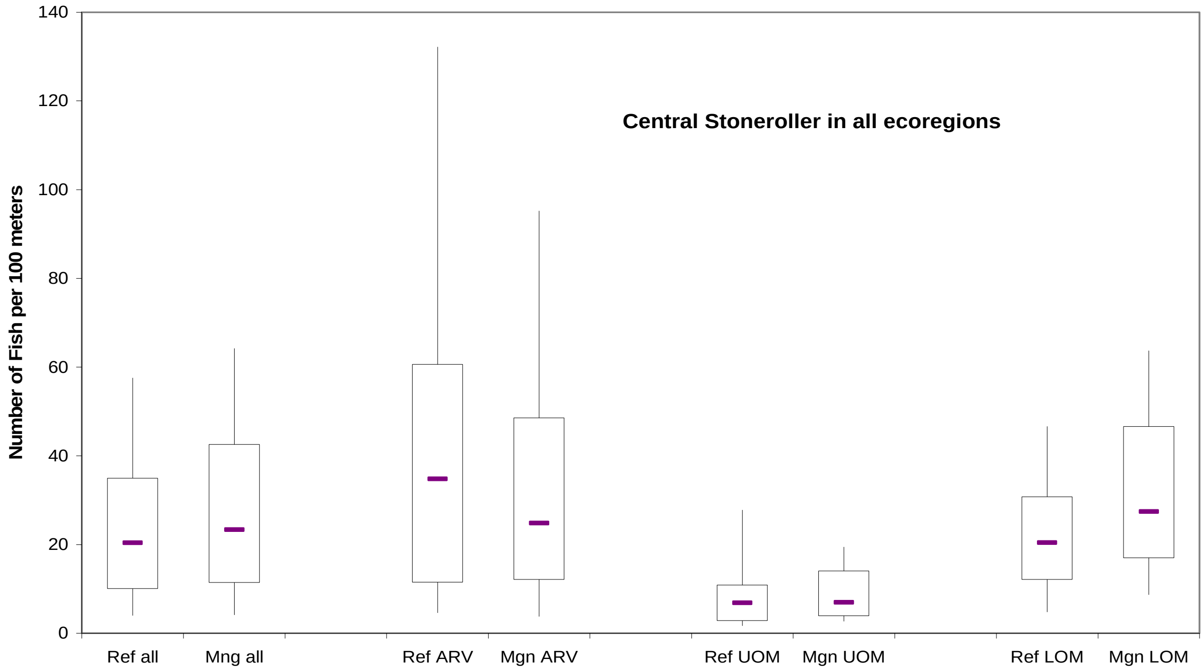

Figure 2.10—Central stoneroller densities in BASS samples, All Ecoregions

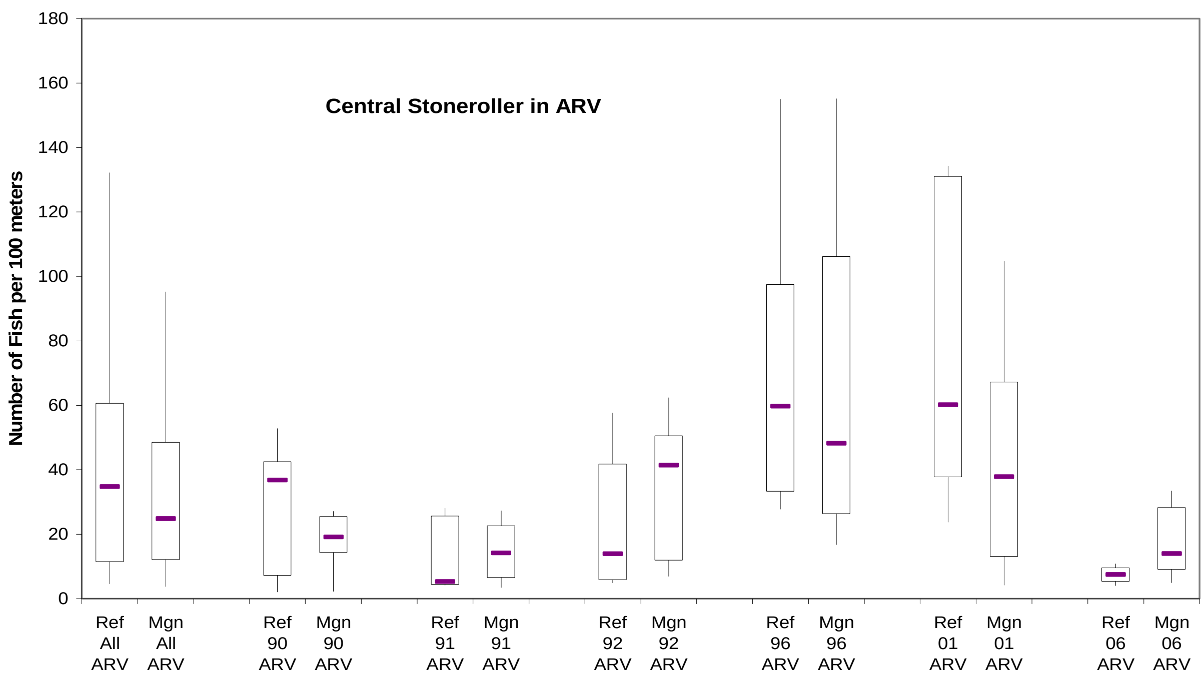

Figure 2.11—Central stoneroller densities in BASS samples, ARV Ecoregion.

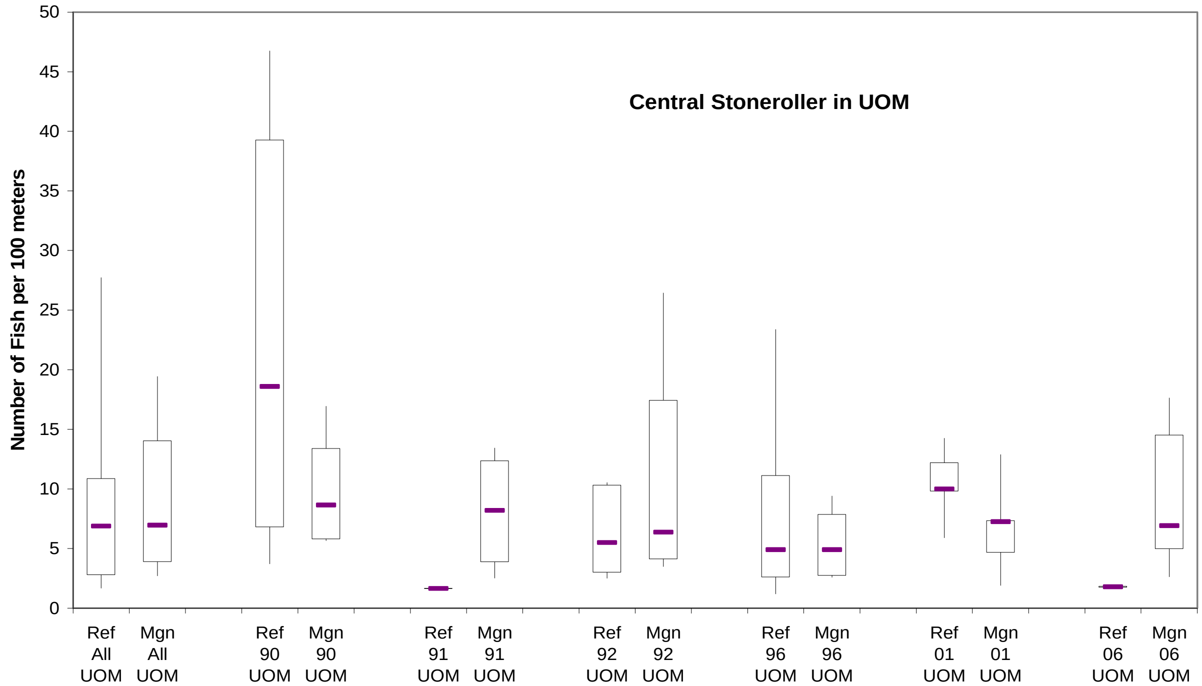

Figure 2.12—Central stoneroller densities in BASS samples, UOM Ecoregion.

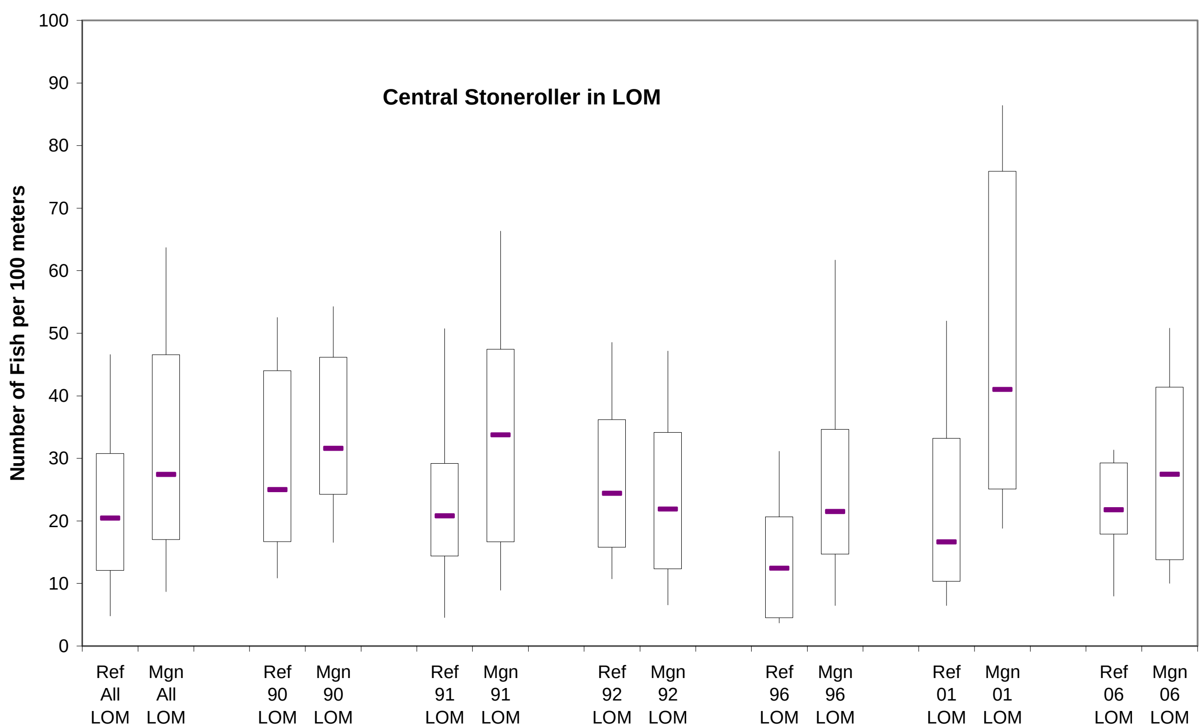

Figure 2.13—Central stoneroller densities in BASS samples, LOM Ecoregion.

Average annual densities from L-TSSR ranged from 46.1 fish per 100 meters in 2000 to 69.1 fish per 100 meters in 2002 (Figure 2.14).

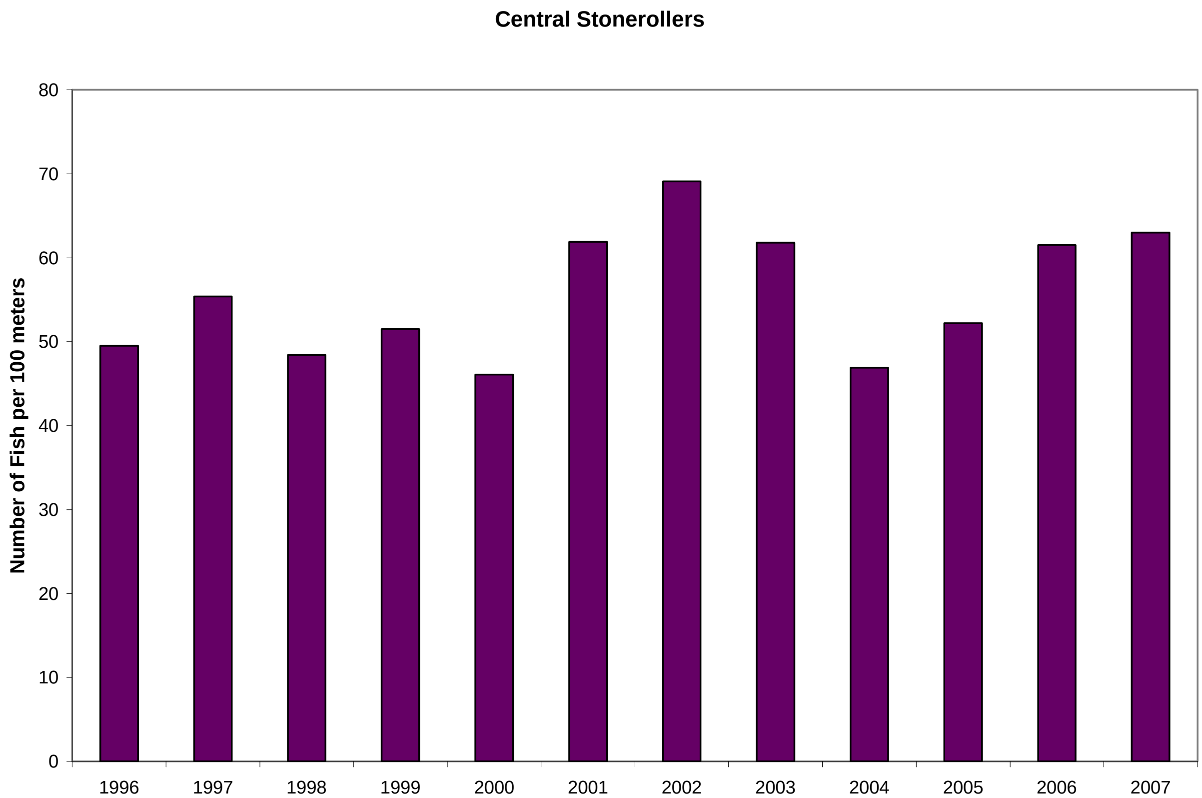

Figure 2.14—Average number of central stonerollers from L-TSSR.

Population Trends: Populations of central stonerollers fluctuate from year to year. Many factors, biotic and abiotic, natural and anthropogenic, contribute to these fluctuations. Over time these populations appear to be stable.

Interpretation of Trends: Percent site occurrence and population densities indicate that managed streams and reference streams are similar. There are no indications that central stonerollers are increasing as a result of management except in the LOM where median population densities in managed steams are higher since 1992.

Consequences for Conservation of the Species: Central stonerollers are widely distributed throughout all of the ecoregions found on the forest. The conservation of this species across the forest is not in question.

Implications for Management: Based on BASS and L-TSSR, there appears to be no adverse effect on central stoneroller populations as a result of forest management activities in the ARV and UOM ecoregions. The LOM has had an increase in unmanaged recreation in the last ten years that may be reflected in the increases in central stoneroller population densities. This in combination with decreased road and trail maintenance suggests an increase in central stoneroller densities as a result of potential habitat alteration from the detrimental influences of increased sediment entering the streams.

Redfin Darter (Etheostoma whipplei)

The redfin darter occurs in the Arkansas and White River drainages above the Fall Line in Missouri, Arkansas, Kansas, and Oklahoma. The redspot darter, which occurs in the Ouachita and Red River drainages in Arkansas, and in portions of Texas, Louisiana, Mississippi, and Alabama (*Etheostoma artesiae*), was considered a subspecies of the redfin darter until recently (Piller et al. 2001). In the Ouachita National Forest, the redfin darter occurs in the UOM and ARV ecosystems, north of the range of the orangebelly darter, which is also an MIS species. Darters, especially of the genus *Etheostoma*, are sensitive to habitat degradation because of their specificity for reproduction and feeding in benthic habitats (Karr et al. 1986; Robison and Buchanan 1988). Such habitats are degraded by activities that result in siltation and habitat alteration.

Data Source: Data sources include the BASS inventories and 20 of 131 samples (18 sites) from L-TSSR. The Robison data had 210 collections at 102 sites. These sites represented 19 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data had 31 collections at 12 sites. These sites represented 7 of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: Redfin darters are common throughout much of the ARV and UOM ecoregions. The percent site occurrence in the ARV was dominated by Dry Creek (Reference) and as high as 100% for five of six years. Percent site occurrence was evenly divided in the UOM for Bread (Managed) and South Alum (Reference) Creeks. The redfin darter was rarely found to occur in the LOM (Table 2.7).

Table 2.7—Percent site occurrence of redfin darters by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Jack (Managed, ARV)	76.9	85.7	62.5	88.9	88.2	100.0
Dry (Reference, ARV)	100.0	100.0	68.8	100.0	100.0	100.0
Bread Creek (Managed, UOM)	78.6	57.1	45.5	50.0	52.9	87.5
South Alum Creek (Reference, UOM)	73.3	25.0	59.1	76.2	78.3	57.1
Brushy Creek (Managed, LOM)	0.0	3.4	0.0	0.0	4.8	0.0
Caney Creek (Reference, LOM)	5.0	0.0	0.0	0.0	0.0	0.0

A comparison of population densities for redfin darters in the ARV for all years and individual years shows that managed streams had slightly higher population densities for all years except for 2006 (Figure 2.15). Information for redfin darters in the UOM show that densities, while variable, were slightly higher in reference streams for all years combined (Figure 2.16).

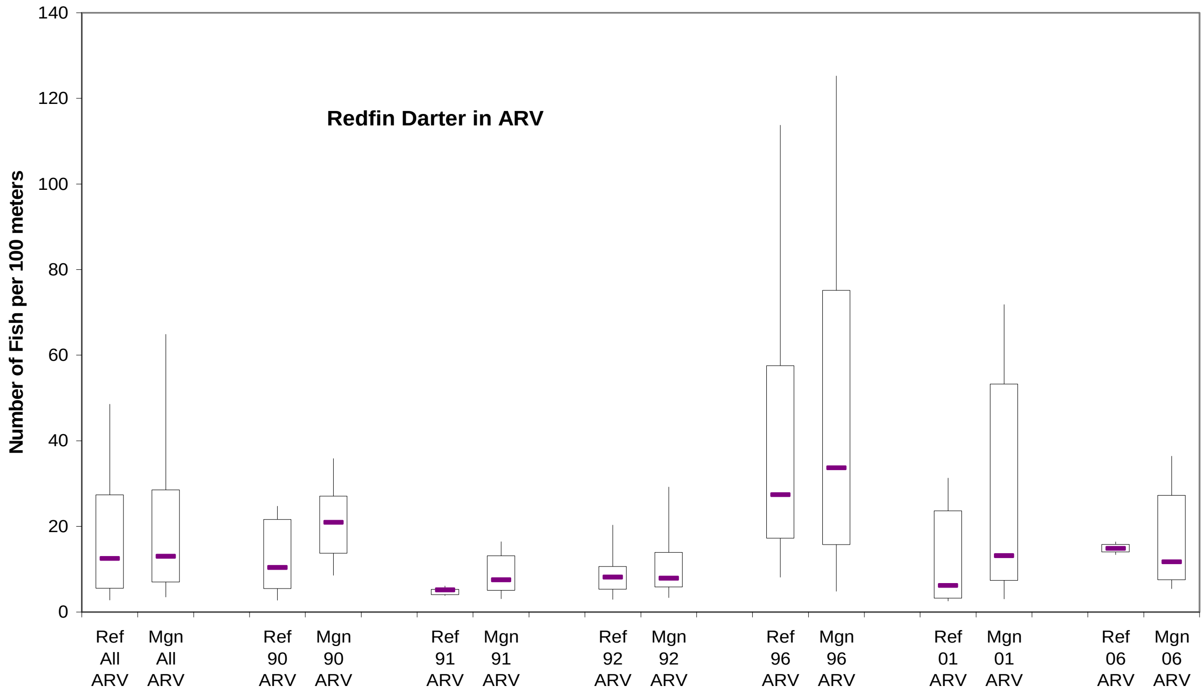

Figure 2.15—Redfin darter densities in BASS samples, ARV.

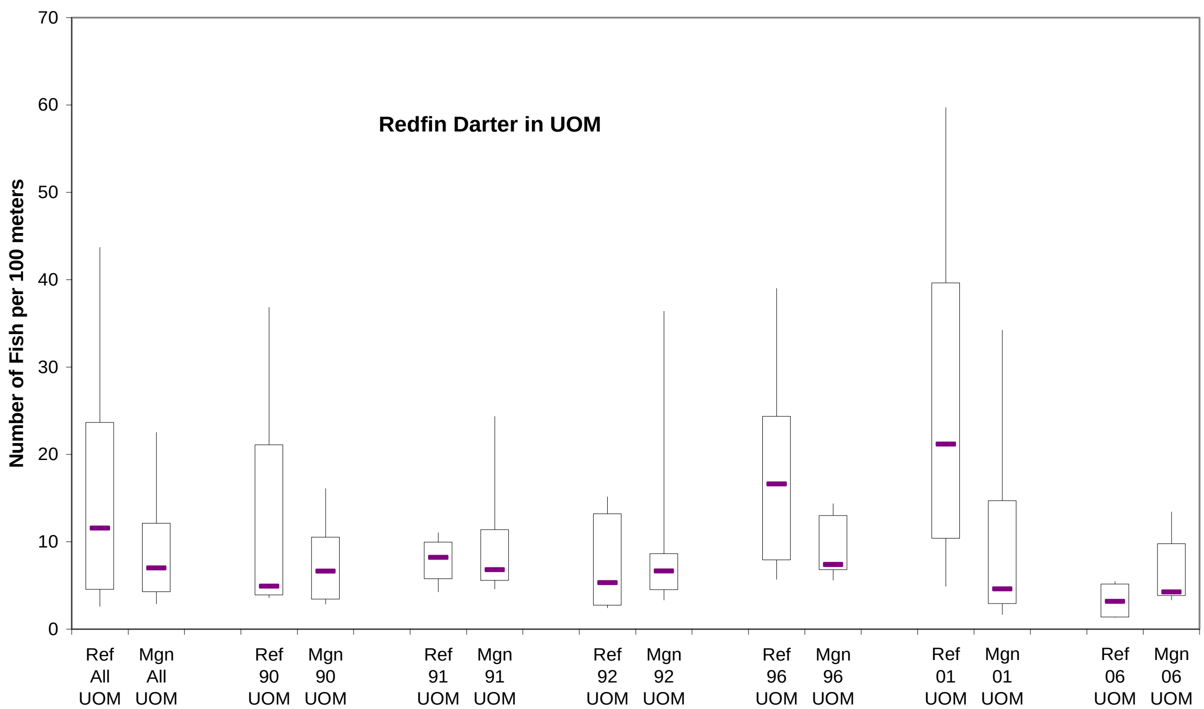

Figure 2.16—Redfin darter densities in BASS samples, UOM.

Average annual densities ranged from 0.0 in 2000 to 3.2 in 2002 fish per 100 meters from L-TSSR. Figure 2.17 shows population densities of redfin darters from West Gafford Creek, a tributary of the Fourche LaFave River.

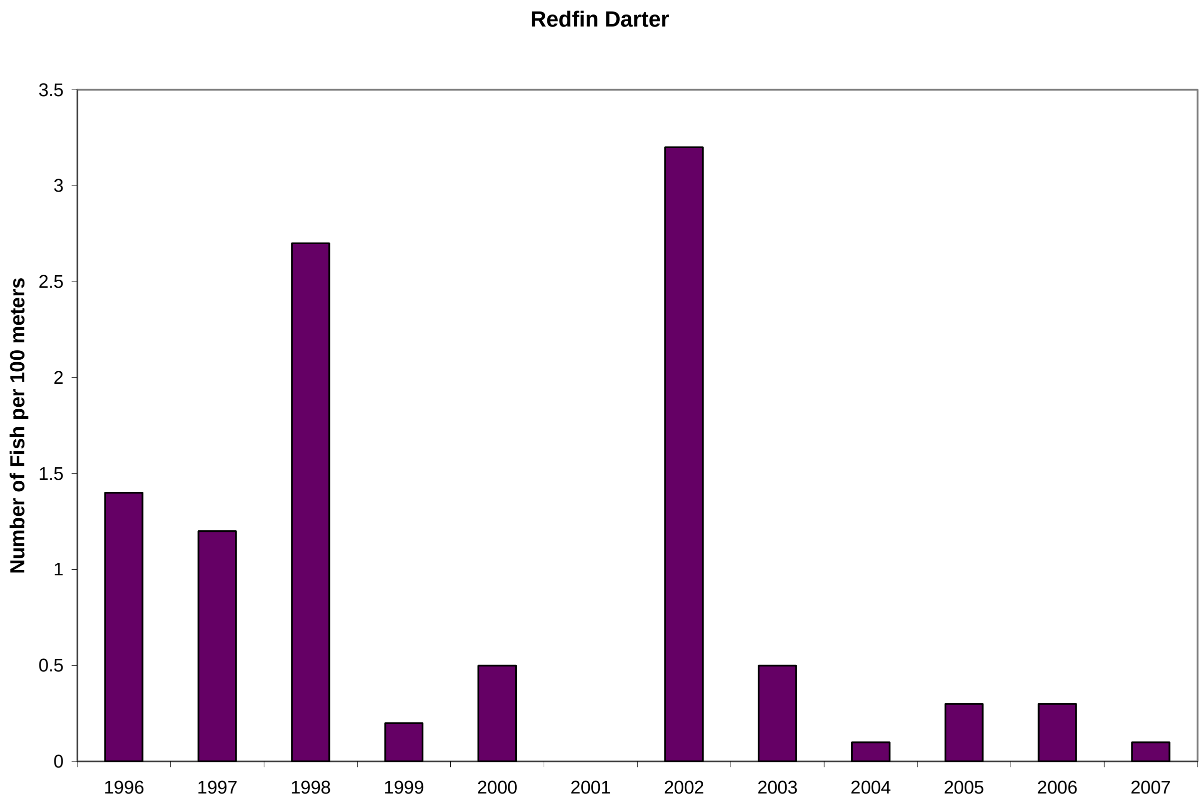

Figure 2.17—Average number of redfin darters from West Gafford Creek.

Population Trends: It appears that while populations of redfin darter fluctuate from year to year they appear to be stable over time.

Interpretation of Trends: Percent site occurrence and population densities indicate that managed streams and reference streams are similar for redfin darter.

Consequences for Conservation of the Species: Redfin darters are commonly distributed throughout much of the ARV and UOM Ecoregions. The conservation of this species is not in question.

Implications for Management: Based on Forest BASS and L-TSSR data, there appears to be no adverse effect on redfin darter populations from forest management activities.

Creek Chubsucker (*Erimyzon oblongus*)

The creek chubsucker range extends from the eastern U.S. from New Brunswick to Florida and west to Iowa, Texas and southeastern Oklahoma. The creek chubsucker is widespread in Arkansas occurring in all major drainages, but is absent from streams in the highest elevations of the Ozarks. It prefers small creeks and streams of moderate gradient. It lives in quiet waters in vegetation, over sand, gravel-bottomed, or debris-laden substrates and is somewhat intolerant of heavy silt loads. Although widely distributed and common in Arkansas, populations of creek chubsuckers tend to be small. It is considered an indicator species by the Arkansas Department of Environmental Quality for the Gulf Coastal Ecoregion.

Data Source: The BASS inventories had occurrences of creek chubsuckers in Dry Creek (Reference ARV), Jack Creek (Managed ARV), South Alum Creek (Reference UOM), and Bread Creek (Managed UOM). A single individual was collected in the LOM throughout this sample period. In addition, creek chubsuckers were found in six of nine L-TSSR samples (1 site) in the ARV and in 45 of 122 L-TSSR samples (17 sites) in the UOM and LOM ecoregions.

Population Trends: Table 2.8 displays percent site occurrence for creek chubsucker. The percent of sample occurrence over time was essentially even for Bread and South Alum Creek (UOM). Jack Creek (ARV, managed) had a general increase over time, while Dry Creek (ARV reference) experienced a general decrease until 2006. Comparing streams by ecoregion, within the ARV, the Managed Jack Creek had a greater percent occurrence of creek chubsuckers for four of six years than the Reference Dry Creek. Within the UOM ecoregion, Managed Bread Creek had a lower percent occurrence for five of six years and was approximately half of the percent occurrence of the Reference South Alum for three years (1990, 1992, and 1996).

Table 2.8—Percent site occurrence of creek chubsucker by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Jack (Managed, ARV)	7.7	23.8	37.5	33.3	11.1	44.4
Dry (Reference, ARV)	41.7	20.0	6.3	9.1	28.6	50.0
Bread (Managed, UOM)	21.4	21.4	18.2	18.2	29.4	75.0
South Alum (Reference, UOM)	40.0	25.0	40.9	38.1	30.4	42.9

There was insufficient sample size to adequately compare population densities by year for the ARV. However, the comparison of all years by site in the ARV showed them to be similar (Figure 2.18). There were insufficient data to compare population densities for the Upper Ouachita Mountain across years. When comparing all years combined, the range of natural variability was also similar in the UOM (Figure 2.19).

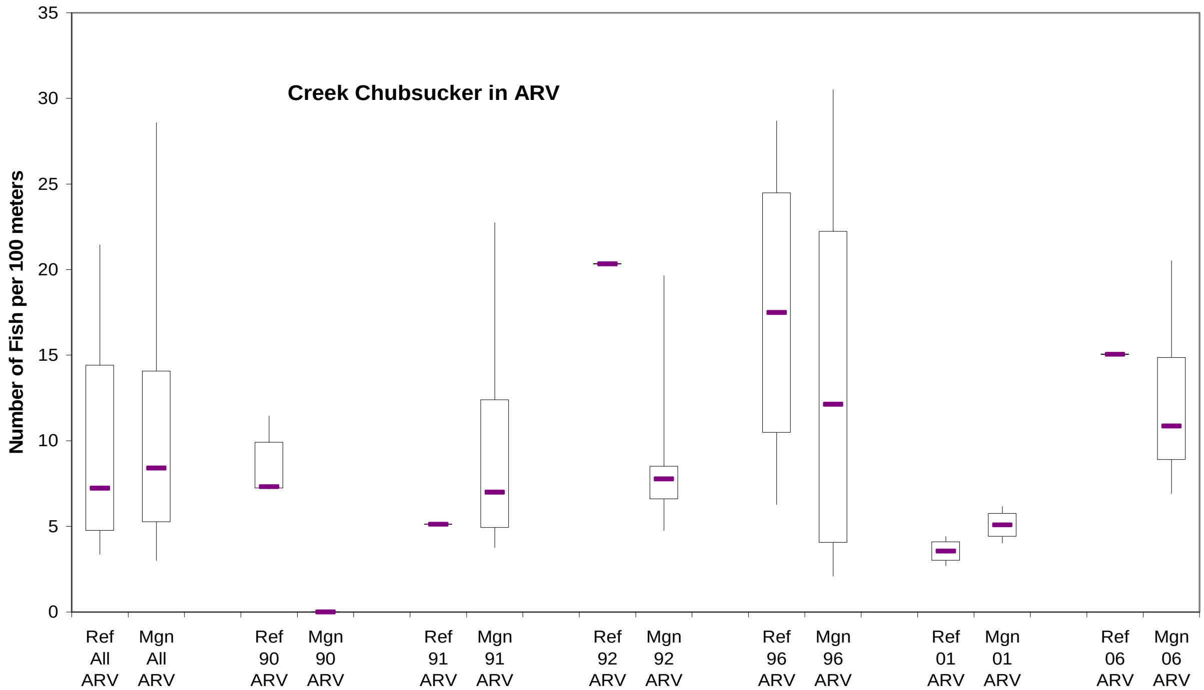

Figure 2.18—Creek chubsucker densities in BASS samples, ARV.

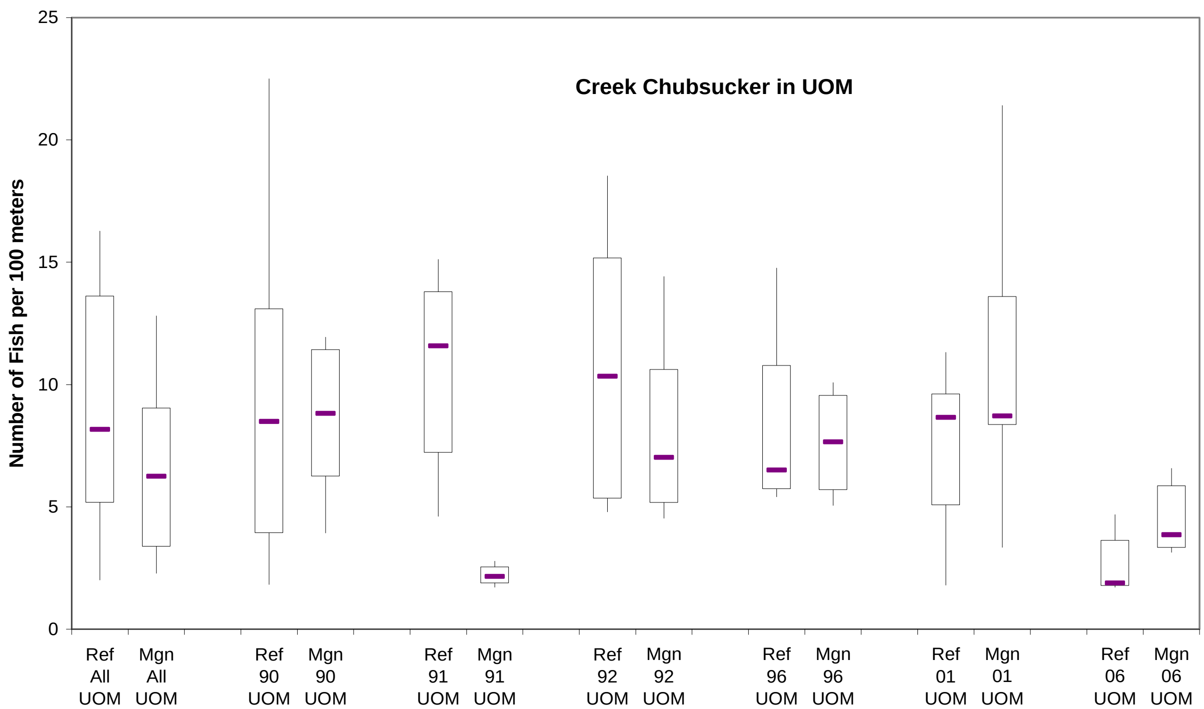

Figure 2.19—Creek chubsucker densities in BASS samples, UOM.

The L-TSSR data showed that species occurrence varied by ecoregion. Table 2.9 values varied from 0 percent to 100 percent. Population densities for selected streams are displayed in Table 2.10.

Table 2.9—Percent occurrence of creek chubsucker from L-TSSR

Stream	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ARV	ns	0	100	100	100	ns	100	0	ns	100	100	0
LOM	25	50	20	0	0	0	0	71	0	27	20	33
UOM	100	50	75	40	100	0	50	67	67	83	50	19

Table 2.10—Number of creek chubsuckers per 100 meters from L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
West Gafford	ARV	ns	0.4	0.7	0.7	2.8	ns	7.7	0.0	ns	0.8	1.8	0.0
Lick Creek	LOM	0.0	1.5	0.9	0.0	ns	ns	ns	1.2	ns	1.0	ns	1.1
Shirley Creek	LOM	1.1	0.0	0.0	ns	ns	ns	ns	4.8	ns	0.0	0.0	0.0
Irons Fork	UOM	ns	0.0	0.9	5.8	ns	0.0	0.9	7.2	15.7	10.3	1.1	0.0
Johnson Creek	UOM	9.57	9.1	5.2	ns	ns	ns	0.0	2.7	ns	7.0	5.9	0.0
Muddy Creek	UOM	ns	1.0	0.0	2.2	2.1	ns	0.0	2.3	ns	1.1	0.0	0.0

ns = not sampled

Interpretation of Trends: Percent population site occurrences were similar over time for Bread, South Alum, Jack, and Dry creeks.

Consequences for Conservation of the Species: Percent site occurrence and population densities are similar for creek chubsuckers in the ARV and UOM and suggest that the conservation of the species is not an issue.

Implications for Management: Population densities for all years combined in the ARV and UOM by reference and managed watersheds showed little difference. There is no indication that management activities are having an effect on populations of creek chubsuckers.

Pirate perch (*Aphredoderus sayanus*)

The pirate perch ranges from Minnesota south through the Mississippi Valley, across the Gulf coast to Florida and north along the Atlantic coast to New York. It occurs in the southeastern corner of Oklahoma in the easternmost tributaries of the Red River and throughout the Coastal Plain physiographic region of Arkansas and other regions where local conditions are favorable. It does not occur in the Ozark Mountains. The pirate perch is a solitary species inhabiting quiet ponds, oxbow lakes, swamps, ditches, and sluggish mud and sand-bottomed small rivers and streams. It is locally abundant over soft mud and silt bottoms with thick vegetation and is found in both clear and turbid waters. It avoids current. The pirate perch is considered an indicator species by the Arkansas Department of Environmental Quality for the Gulf Coastal Ecoregion.

Data Source: The BASS inventories found the pirate perch to occur only in the Upper Ouachita Mountain Ecoregion. Pirate perch were found in 22 of 131 L-TSSR samples (18 sites) conducted on the Forest between 1996 and 2007. The Robinson data include 37 collections from 33 sites. These sites were found in 12 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data identified 56 collections from 49 sites. These sites were representative of 7 of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: The percent site occurrence of samples where pirate perch were found in the UOM BASS inventories is presented in the following table (2.11). Comparing the percent occurrence of Bread and South Alum by year, Bread Creek has lower occurrences for all years than South Alum except for 2006, and significantly lower percentages for 1991, 1992 and 2001. Looking at percent occurrence over time, Bread and South Alum creeks both show similar patterns with declines in 1991 and 1992.

Table 2.11—Percent site occurrence of pirate perch by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Bread Creek (Managed, UOM)	35.7	0.0	4.5	31.8	11.8	75.0
South Alum Creek (Reference, UOM)	46.7	16.7	22.7	38.1	30.4	71.4

Figure 2.20 displays the population densities for all years and by year for pirate perch in the Upper Ouachita Mountain ecoregion. There is insufficient sample size to discuss 1991 and 1992. In comparing the natural range of variability for population density, there appears to be little difference as a result of management activities between 1990, 1996, and for all years combined. Population densities were much greater for Bread Creek in 2001.

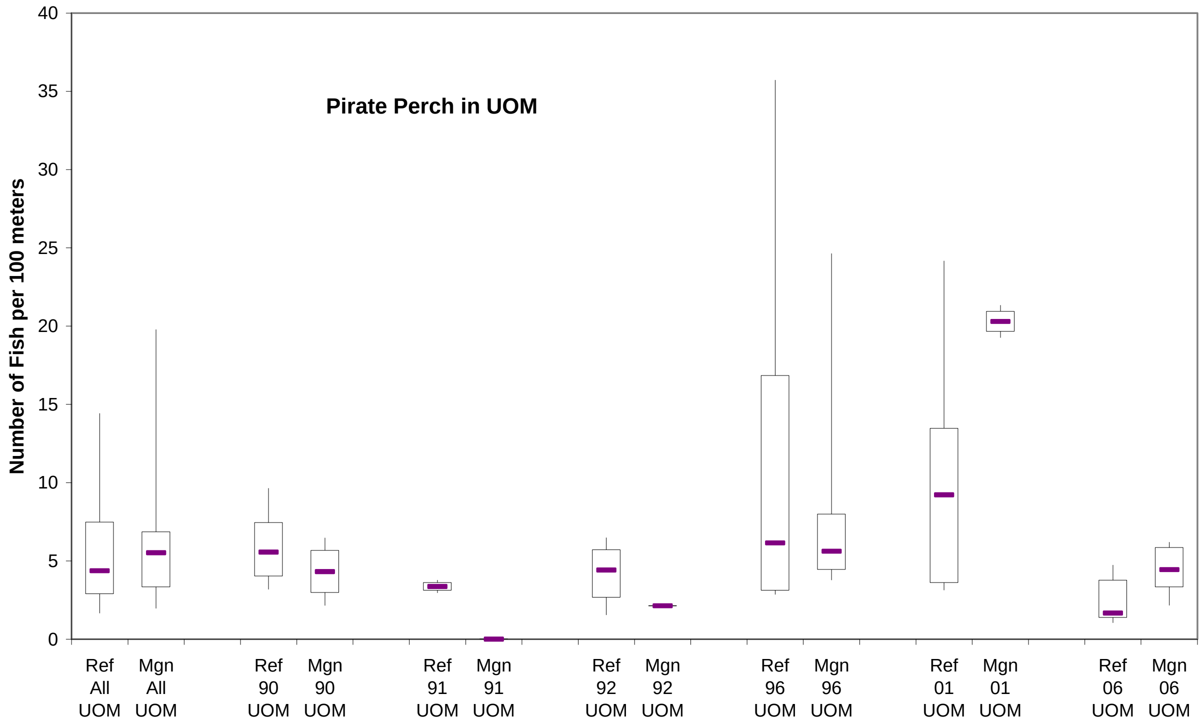

Figure 2.20—Pirate perch densities in BASS samples, UOM.

From L-TSSR the percent site occurrence is displayed in Table 2.12. This shows a wide range in occurrence levels similar to the BASS inventories. Table 2.13 displays the population densities as the number of fish per 100 meters and Figure 2.20 displays population densities from L-TSSR.

Table 2.12—Percent site occurrence of pirate perch from L-TSSR

Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
LOM	0	25	20	0	0	0	0	28	0	36	10	10
UOM	0	17	25	20	0	100	33	17	33	33	17	15

Table 2.13—Number of pirate perch per 100 meters from L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lick Creek	LOM	0.0	0.0	0.9	0.0	ns	ns	ns	2.4	ns	2.0	ns	4.5
Irons Fork	UOM	ns	3.8	1.9	0.9	ns	0.9	2.8	6.2	2.9	0.9	1.1	0.9

ns = not sampled

Interpretation of Trends: Percent site occurrence indicates that managed streams may have a lower site occurrence, but similar population densities. There was a marked decline in population densities for three of the six years sampled.

Consequences for Conservation of the Species: The conservation of this species is more closely linked to the Gulf Coastal Ecoregion of which there is little influence by Ouachita National Forest management activities. However, from the evidence available from the BASS inventories, there does not appear to be problems with the conservation of this species.

Implications for Management: Given similar population densities where there is adequate sample size, there appears to be no effect on populations as a result of management.

Northern hog sucker (*Hypentelium nigricans*)

The northern hog sucker occurs in the eastern U.S., excluding southern Georgia, Florida, and Alabama. In Oklahoma it is found only in the Ozark Region. It lives in clear, permanent streams with gravel or rocky substrate and generally prefers deep riffles, runs, or pools having a current. It is intolerant of pollution, silt, and stream channel modification. The northern hog sucker is considered to be a key species within the Ouachita Mountain Ecoregion.

Data Source: Northern hog suckers were not collected in any of the BASS inventories. Of the 122 L-TSSR, northern hog suckers occurred in 44 samples (17 sites). Ten of the 14 occurrences were in the LOM ecoregion.

Table 2.14 gives the percent site occurrence of northern hog suckers in L-TSSR within the UOM and LOM ecoregions from 1996 through 2007. Figure 2.21 shows population densities at the sites in which northern hog suckers occurred for the same time period. Table 2.15 illustrates population densities per 100 meters from L-TSSR data. To aid in the interpretation of the figure, zero results are displayed in the figure as a negative.

Table 2.14—Percent site occurrence of northern hog suckers from L-TSSR.

Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
UOM	0	17	25	40	0	0	17	0	33	33	17	2
LOM	50	50	40	33	50	80	0	43	40	73	30	56

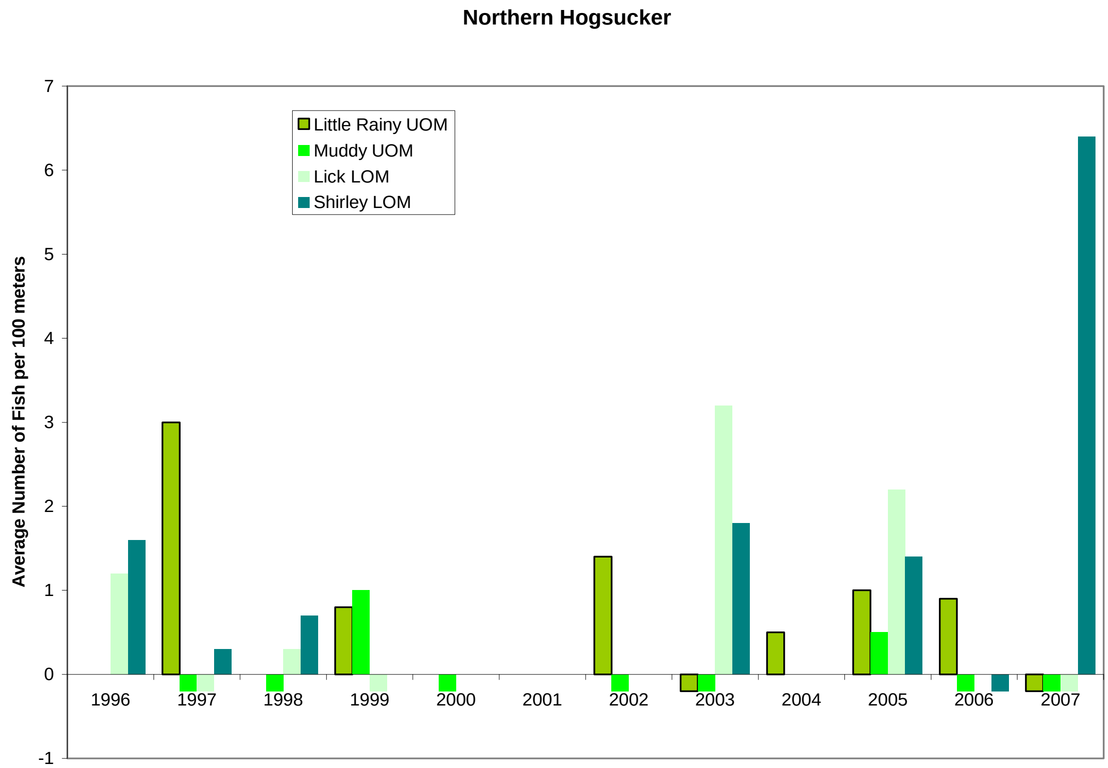

Figure 2.21—Catch per unit effort from L-TSSR within the LOM and UOM ecoregions.

Table 2.15—Number of northern hog sucker per 100 meters from L-TSSR.

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lick Creek	LOM	2.0	0.0	0.9	0.0	ns	ns	ns	4.8	ns	3.0	ns	0.0
Shirley Creek	LOM	2.3	0.6	0.6	ns	ns	ns	ns	3.2	ns	2.9	0.0	8.6
Williams Creek	LOM	ns	6.6	0.0	ns	ns	ns	ns	0.0	ns	10.0	0.0	2.2
Little Rainy	UOM	ns	2.6	ns	2.7	ns	ns	2.7	0.0	2.7	3.4	1.1	ns
Muddy Creek	UOM	ns	0.0	0.0	2.2	0.0	ns	0.0	0.0	ns	1.1	0.0	0.0

ns = not sampled

Robison identified 117 collections of northern hog sucker from 58 sites. Those sites represented 12 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. These sites were located almost exclusively in the Ouachita, Caddo and Little Missouri River drainages.

Population Trends: From the L-TSSR data, the average number of individuals per sample was 1.6. The average number of individuals per sample for Robinson's data was 2.7.

Interpretation of Trends: In the Ouachita Mountains, the northern hog sucker is restricted to the Ouachita, Caddo, Little Missouri, and Saline drainages. It is absent from the Cossatot River

Drainage where the Reference and Managed watersheds for the LOM ecoregion occur. This explains its absence from the BASS inventories. It occurred in 44 of 122 samples from the L-TSSR (36.1%). From the Robison data restricted to the same locations, it was collected from 58 of 176 sites (33.0%). It appears that northern hog sucker populations on the Ouachita National Forest remain stable.

Consequences for Conservation of the Species: There is no information to suggest that the northern hog sucker has conservation concerns on National Forest Lands.

Implications for Management: There is no information to suggest that management activities are having a direct or indirect effect on populations of the northern hog sucker.

Northern studfish (*Fundulus catenatus*)

This species occurs in the Midwestern and southern U.S., occurring only in the northeast corner of Oklahoma. In Arkansas, it occurs in the Ozark and Ouachita mountains in clear streams and rivers of moderate to high gradient and permanent flow. It is usually found in quiet, shallow waters along the margins of pools having rock and gravel substrate. The northern studfish is considered an indicator species by the Arkansas Department of Environmental Quality for the Ouachita Mountain Ecoregion.

Data Source: Data sources include the BASS inventories and 37 of 71 L-TSSR samples (11 sites) (all from the LOM Ecoregion). The Robison data had 286 collections from 135 sites. These sites represent 19 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. These watersheds comprise the Lower Ouachita Mountain (LOM) ecoregion. No collections were found in the Fisher data for Oklahoma.

Population Trends and Interpretation of Trends: Table 2.16 displays the percent site occurrence for northern studfish in Brushy and Caney Creeks for the years displayed. Occurrence varied widely. Brushy Creek had relatively high percent occurrences in all years. Caney Creek data indicated a decline from 1990 through 1996 then a recovery to former levels in 2001 and 2006.

Table 2.16—Percent site occurrence of northern studfish by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Brushy Creek (Managed, LOM)	63.0	24.1	46.7	15.6	76.2	80.0
Caney Creek (Reference, LOM)	25.0	18.0	12.5	5.4	29.0	27.8

Figure 2.22 displays the population densities for all years and by year for northern studfish within the LOM ecoregion. Comparing the natural range of variability for population density, there appears to be higher population densities within the managed watersheds for all years except 1992 and for all years combined.

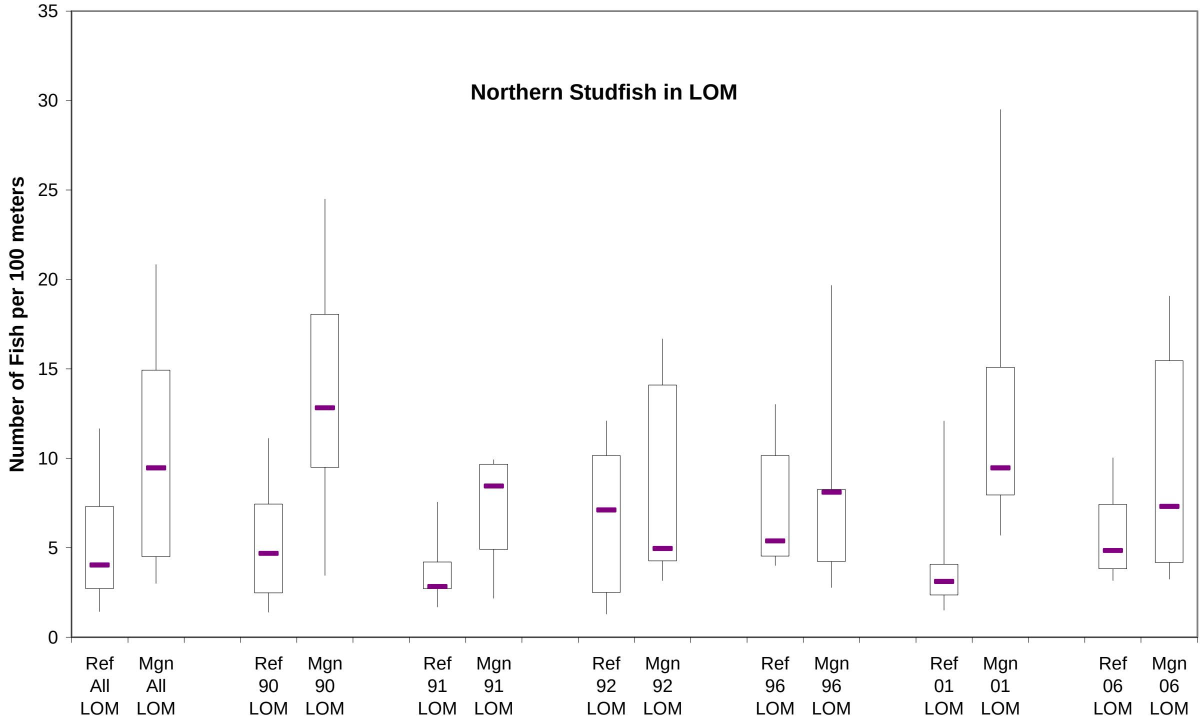

Figure 2.22—Northern studfish densities in BASS samples, LOM.

Table 2.17 gives the percent site occurrence of northern studfish from the L-TSSR within the LOM. Table 2.18 shows populations densities at the sites in which northern studfish occurred, for the same time period. It appears that population densities are highly variable over time. From this information it appears that northern studfish have very wide fluctuations in percent site occurrence and densities.

Table 2.17—Percent site occurrence of northern studfish from L-TSSR

Stream	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
LOM	75	50	20	33	75	40	0	71	40	64	40	67

Table 2.18—Number of northern studfish per 100 meters L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lick Creek	LOM	5.9	0.0	0.0	0.0	ns	ns	ns	3.6	ns	3.0	0.0	1.1
Shirley Creek	LOM	11.4	0.0	0.0	ns	ns	ns	ns	1.6	ns	0.0	1.1	15.8
Blaylock Creek D	LOM	ns	ns	ns	2.5	2.7	3.9	ns	ns	6.5	2.0	0.0	ns
Long Creek D	LOM	ns	ns	ns	0.9	0.0	0.0	ns	ns	0.0	1.2	1.3	1.3

ns = not sampled

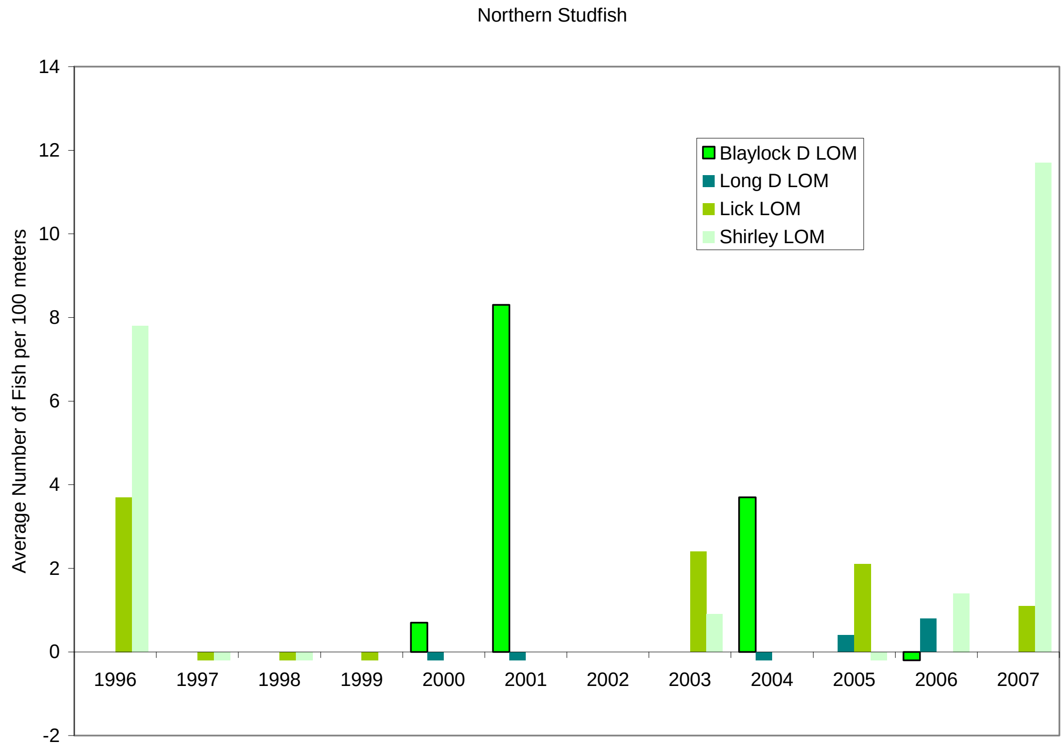

Figure 2.23—Catch per unit effort of northern studfish from L-TSSR, LOM.

Consequences for Conservation of the Species: Northern studfish are commonly distributed throughout the LOM ecoregion. Wide fluctuations of percent occurrence and population densities appear to be common. Because of the common occurrence across a wide area the conservation of this species is not threatened. However, additional monitoring will provide insight into the nature of the wide annual fluctuations.

Implications for Management: There are no adverse implications for northern studfish populations as a result of management activities.

Orangebelly darter (*Etheostoma radiosum*)

The orangebelly darter is endemic to tributaries of the Red and Ouachita rivers in southeastern Oklahoma and southwestern Arkansas. This species seems to have a broad ecological niche, since it occurs in a variety of habitats from small, gravelly, high-gradient streams to larger, more sluggish lowland rivers. Like most darters, however, it is sensitive to the effects of siltation and seems to be most common in clear, gravel cobble-bottomed streams with moderate to high gradient. The orangebelly darter is the most abundant darter in the LOM and UOM ecoregions of Arkansas. It is able to adapt somewhat to habitat alteration, and it apparently has the ability to repopulate areas that have been environmentally disturbed after the disturbance has been removed, however heavy silts loads would be detrimental to this species. It is considered a key species by the Arkansas Department of Environmental Quality for the Ouachita Mountain Ecoregion.

Data Source: Data sources include the BASS inventories, 101 of 122 L-TSSR samples (17 sites) from the LOM and UOM ecoregions. The Robison data had 577 collections at 229 sites. These sites represented 27 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data had 298 collections at 206 sites. These sites represented 14 of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: Orangebelly darters are common throughout much of the LOM and UOM ecoregions. The percent site occurrence in the LOM (Table 2.19) ranged from 87.5 to as high as 100%. Present occurrence in Caney Creek (reference) compared to Brushy Creek (managed) were lower through 1996 and higher in 2001 and 2006.

Table 2.19—Percent site occurrence of orangebelly darters by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Brushy Creek (Managed, LOM)	100.0	89.7	96.7	87.5	95.2	90.0
Caney Creek (Reference, LOM)	95.0	84.0	79.2	80.4	100.0	94.4

A comparison of population densities for orangebelly darters in the LOM ecoregion for all years and individual years shows that managed streams had higher median population densities for all years until 2006 (Figure 2.24).

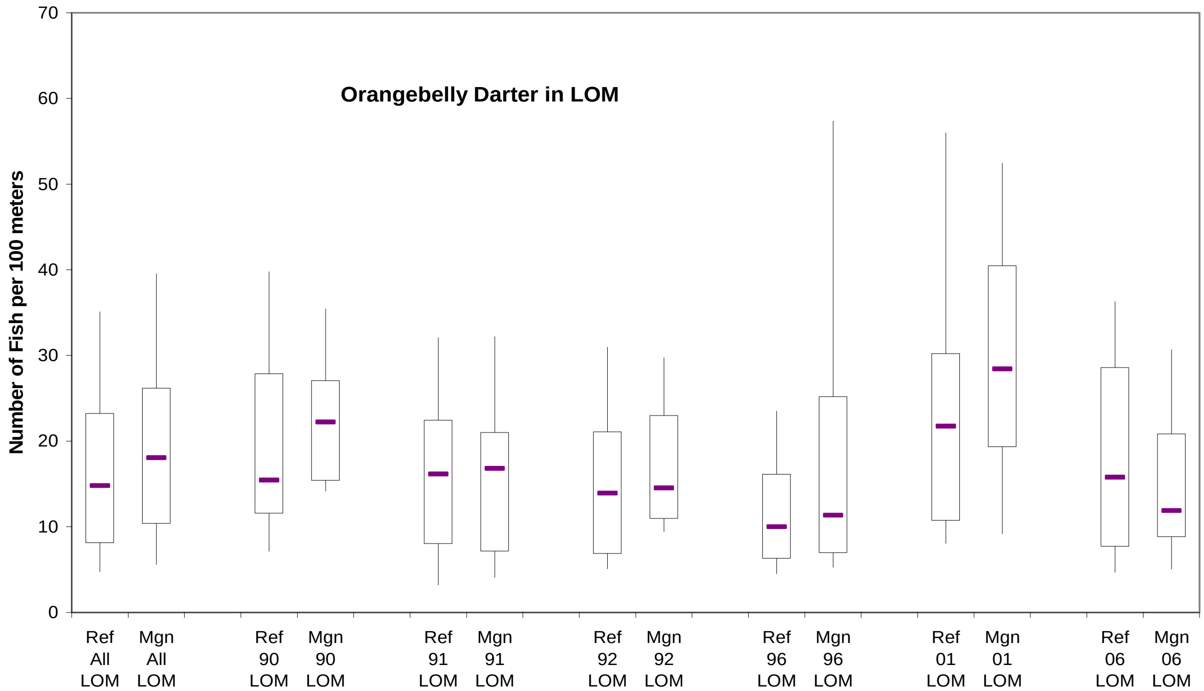

Figure 2.24—Orangebelly darter densities in BASS samples, LOM.

Table 2.20 illustrates the percent site occurrence for orangebelly darters by ecoregion from L-TSSR. Table 2.21 and Figure 2.25 show populations densities at L-TSSR sites in which orangebelly darters occurred.

Table 2.20—Percent site occurrence of orangebelly darter from L-TSSR

Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
LOM	100	100	100	80	100	100	100	100	100	100	90	100
UOM	0	67	75	80	100	100	67	67	67	67	33	67

Table 2.21—Number of orangebelly darters per 100 meters from L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lick Creek	LOM	33.6	25.8	9.3	22.6	ns	ns	ns	38.1	ns	7.1	ns	3.4
Shirley Creek	LOM	31.9	8.7	10.9		ns	ns	ns	46.3	ns	26.5	2.3	4.3
Blaylock Creek D	LOM	ns	ns	ns	31.0	6.7	9.1	ns	ns	10.9	5.9	6.2	ns
Long Creek D	LOM	ns	ns	ns	16.3	5.0	14.0	ns	ns	28.3	33.5	6.5	3.8
Little Rainy Creek	UOM	ns	10.6	ns	21.2	ns	ns	72.9	29.9	29.5	2.26	0.0	10.3
Muddy Creek	UOM	ns	51.5	28.5	9.9	14.9	ns	121.8	40.5	ns	5.5	1.0	17.4

ns = not sampled

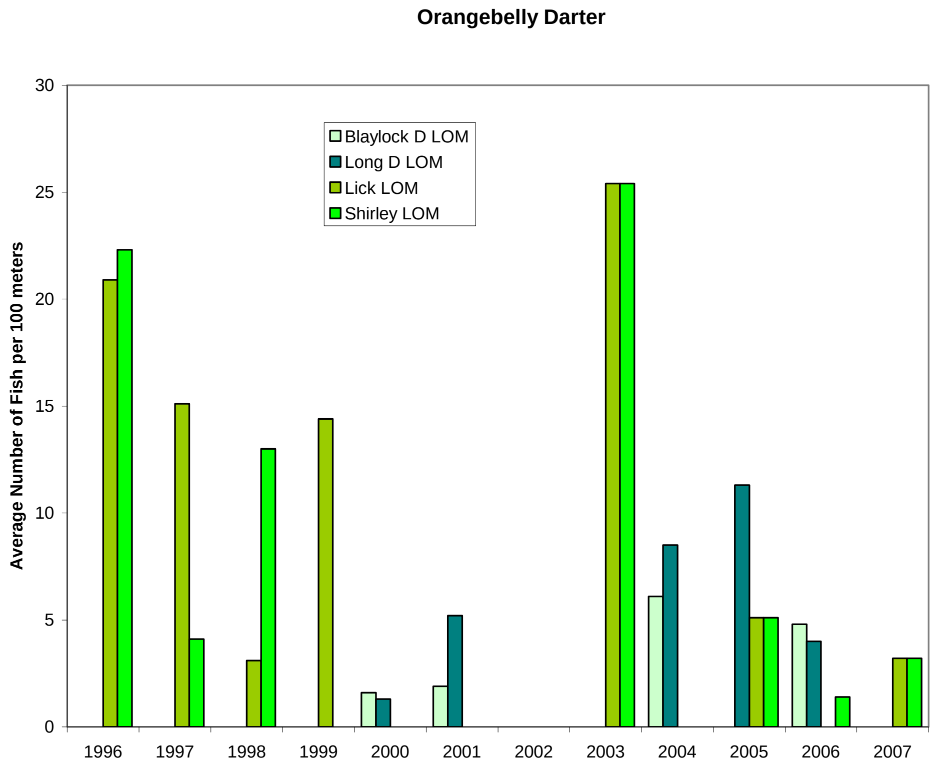

Figure 2.25—Catch per unit effort for orangebelly darters, L-TSSR, LOM and UOM.

Interpretation of Trends: There is a very high occurrence of orangebelly darters in the Ouachita National Forest, particularly in the LOM ecoregion. In general the population appear to be stable over the period surveyed. However, percent site occurrence between managed and reference streams has reversed between 1996 and 2001. In addition population densities appear to have reversed in 2006.

Consequences for Conservation of the Species: Orangebelly darters are commonly distributed throughout much of the LOM and UOM ecoregions. The conservation of this species within these ecoregions is not in question.

Implications for Management: Based on BASS and L-TSSR data, there is cause for concern that current forest management activities within the LOM ecoregion are causing adverse effects on orangebelly darter populations when looking at percent occurrence and population densities. Increases in unmanaged recreation (OHV use) and a lack of road and trail maintenance funds may cause declines in population occurrence and densities in managed streams. The effects of degraded aquatic habitat from increased sediment are suggested as well in yellow bullhead, green sunfish and central stonerollers.

Striped shiner (*Luxilus chrysocephalus*)

This species occurs from New Brunswick to Saskatchewan in the north through the Great Lakes and Mississippi Valley to Oklahoma, Louisiana, and Alabama. It is abundant in the Ozark and Ouachita Mountains and seems to prefer small to moderate-sized perennial streams with permanent flow, clear water, and rocky or gravel substrate. It is found in some current, but avoids strong current preferring the pool habitats within the streams. The striped shiner is considered an indicator species by the Arkansas Department of Environmental Quality for the Ouachita Mountain Ecoregion.

Data Source: Striped shiners were collected in the BASS inventories and in 72 of 131 L-TSSR samples (18 sites). In addition, Robison had 286 collections from 139 sites. These sites represented 21 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. Fisher's data had 55 collections from 43 sites representing six of 24 fifth-level watersheds associated with the Ouachita National Forest in Oklahoma.

Population Trends: Table 2.22 displays the percent site occurrence of striped shiners for Brushy and Caney Creeks for all years sampled. Comparing Brushy Creek to Caney Creek by year, Brushy Creek has a lower percent occurrence for five of six years.

Table 2.22—Percent site occurrence of striped shiners by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Brushy Creek (Managed, LOM)	59.3	20.7	40.0	12.5	42.9	75.0
Caney Creek (Reference, LOM)	85.0	60.0	50.0	35.7	41.9	83.3

Figure 2.26 compares population densities for individual years and all years combined for striped shiners within the LOM ecoregion.

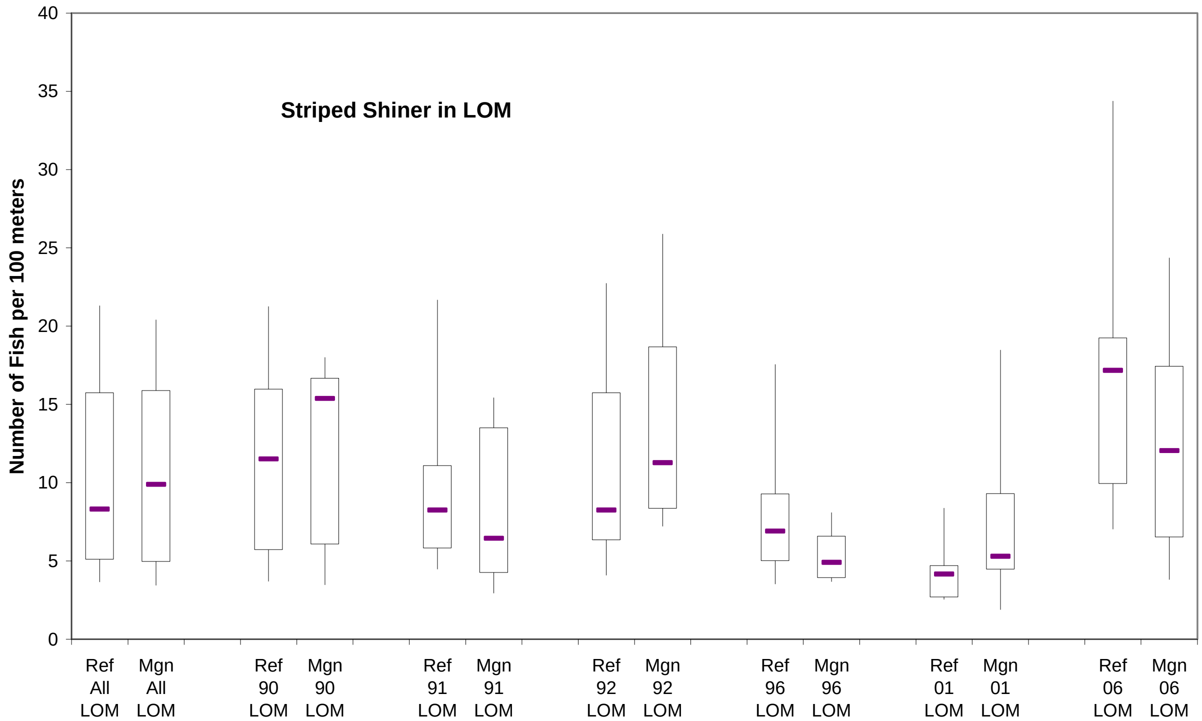

Figure 2.26—Striped shiner densities in BASS samples, LOM.

Table 2.23 shows percent occurrence from L-TSSR sites. Table 2.24 and Figure 2.27 show populations densities at L-TSSR sites in which striped shiners occurred.

Table 2.23—Percent site occurrence of striped shiner from L-TSSR

Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
LOM	75	100	80	67	100	100	100	100	100	82	100	100
UOM	0	83	100	60	100	100	67	67	100	67	50	50

Table 2.24—Number of striped shiners per 100 meters from L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lick Creek	LOM	59.2	8.3	14.8	1.1	ns	ns	ns	10.7	ns	15.5	ns	15.9
Shirley Creek	LOM	22.8	1.7	3.0	0.0	ns	ns	ns	8.6	ns	6.8	7.2	38.1
Blaylock Creek D	LOM	ns	ns	ns	ns	9.8	5.0	ns	ns	6.7	ns	4.8	ns
Long Creek D	LOM	ns	ns	ns	ns	4.6	1.6	ns	ns	3.2	2.5	13.6	ns

ns = not sampled

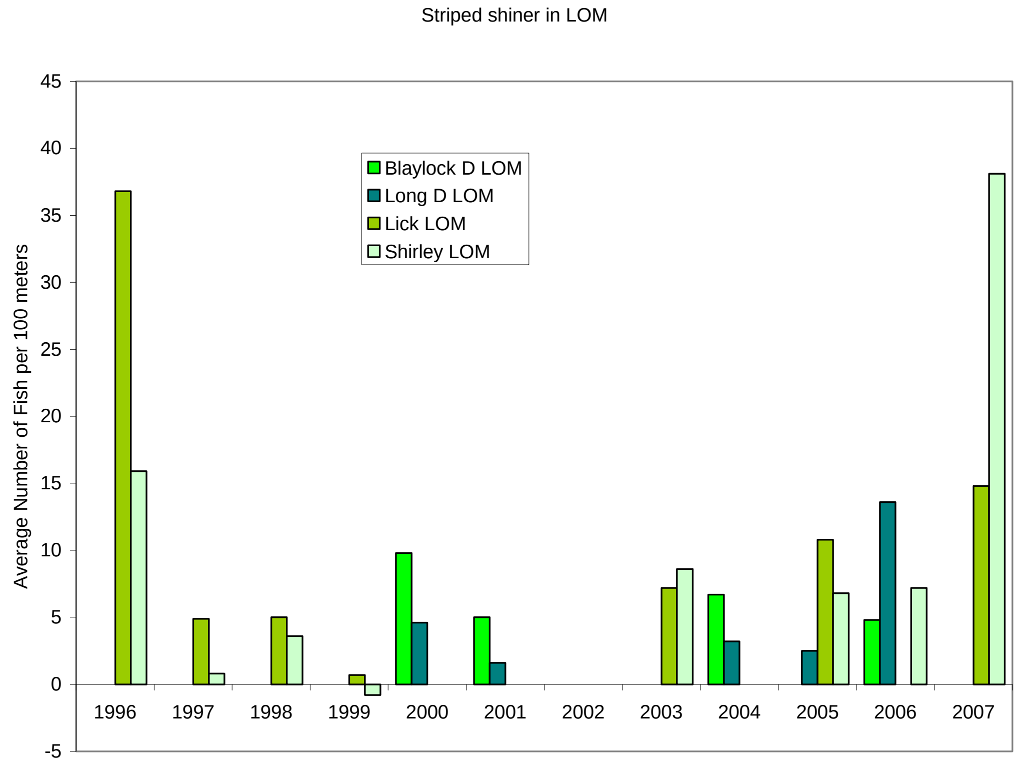

Figure 2.27—Striped shiner catch per unit effort from L-TSSR, LOM and UOM.

Interpretation of Trends: There appear to be wide fluctuations in populations of striped shiners on the Forest, with no apparent upward or downward trends.

Consequences for Conservation of the Species: Striped shiners are common throughout the LOM ecoregions. The conservation of this species in the Ouachita National Forest is not in question.

Implications for Management: Based on BASS and L-TSSR data, there appears to be no adverse effect on striped shiner populations from forest management activities.

Smallmouth bass (*Micropterus dolomieui*)

Smallmouth bass occur in the northeastern U.S. from the Great Lakes and southeastern Canada, west to South Dakota and Iowa, and south to eastern Oklahoma, Arkansas, and northern Alabama. It is found in all major drainages of the Ozark and Ouachita uplands and is mainly an inhabitant of cool, clear mountain streams with permanent flow and rocky bottoms. It is more intolerant of habitat alteration than any of the other black basses, and is especially intolerant of high turbidity and siltation. The smallmouth bass is considered a key species by the Arkansas Department of Environmental Quality of the Ouachita Mountain Ecoregion.

Data Source: Smallmouth bass were collected in BASS inventories and in 46 of 71 L-TSSR samples (11 sites) in the LOM ecoregion. The Robison data disclosed 130 collections from 80 sites. This represents 20 of 48 fifth-level watersheds associated with the Ouachita National Forest in Arkansas. The Fisher data found 79 collections from 49 sites. These sites represent 12 of 24 fifth-level watersheds associated with Ouachita National Forest in Oklahoma.

Population Trends: Table 2.25 displays the percent site occurrence of smallmouth bass for Brushy and Caney Creeks for all years sampled. Both streams show a decline in the percent occurrence from 1990 to 1991 and another sharp decline in 1996 with some recovery through 2006.

Table 2.25—Percent site occurrence of smallmouth bass by year, BASS surveys

Stream	1990	1991	1992	1996	2001	2006
Brushy Creek (Managed, LOM)	51.9	20.7	26.7	9.4	28.6	45.0
Caney Creek (Reference, LOM)	67.5	38.0	29.2	8.9	22.6	27.8

Figure 2.28 compares BASS population densities for Brushy Creek (managed) and Caney Creek (reference) for all years and individual years. It shows that while there are fluctuations from year to year the population densities for reference and managed streams are comparable. Both streams may have a slight decrease in population densities in 2001 and 2006.

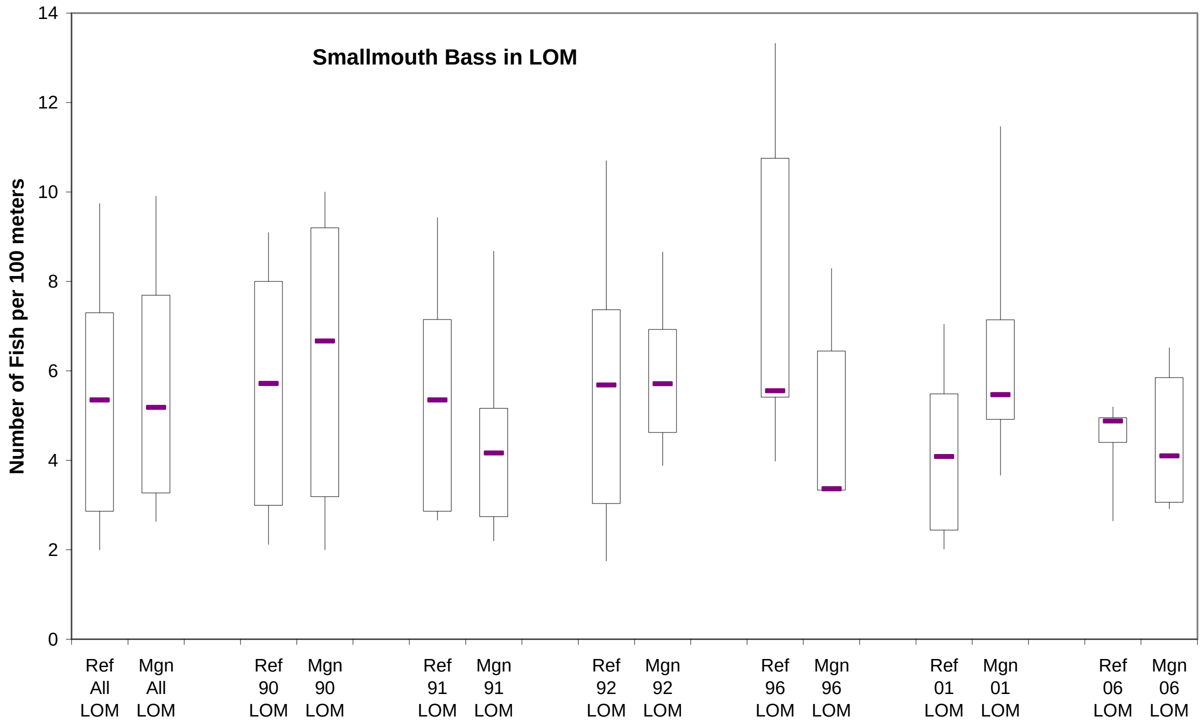

Figure 2.28—Smallmouth bass densities in BASS samples, LOM.

Table 2.26 gives the percent site occurrence of smallmouth bass in L-TSSR within the LOM ecoregion. Table 2.27 shows population densities at L-TSSR in which smallmouth bass occurred, for the period 1996-2007. To aid in the interpretation of the figure, zero results are displayed in the figure as a negative.

Table 2.26—Percent site occurrence of smallmouth bass from L-TSSR

Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
LOM	100	50	50	40	100	100	100	28	100	64	60	67

Table 2.27—Number of smallmouth bass per 100 meters from L-TSSR

Stream	Ecoregion	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Williams	LOM	ns	3.3	0.0	ns	ns	ns	ns	0.0	ns	2.5	0.0	2.2
Two Mile Creek	LOM	2.8	ns	1.7	5.6	ns	1.9	ns	0.0	ns	6.1	0.9	7.8
Blaylock Creek D	LOM	ns	ns	ns	7.4	10.7	5.6	ns	ns	1.1	0.0	3.1	ns
Long Creek D	LOM	ns	ns	ns	11.5	4.0	4.3	ns	ns	5.4	5.0	5.2	1.3

ns = not sampled

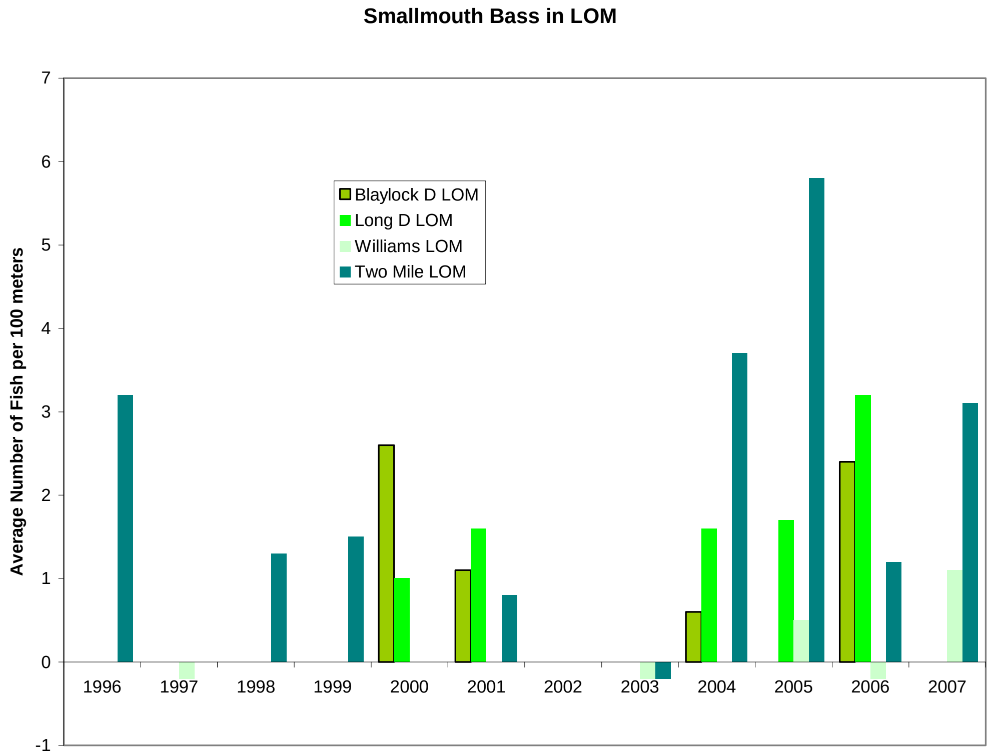

Figure 2.29—Smallmouth bass catch per unit effort from L-TSSR, LOM.

Interpretation of Trends: There appear to be wide fluctuations in populations of smallmouth bass on the Forest, with no apparent trends. A slight decline may be appearing in the population densities from BASS data in 2001 and 2006.

Consequences for Conservation of the Species: Smallmouth bass are commonly distributed throughout the LOM ecoregion. There is minor risk for conservation of the species. Additional monitoring will provide insight as to the nature of the wide annual fluctuations.

Implications for Management: Because both site occurrence percentages and population densities are similar between reference and managed watersheds (BASS data), there is no indication that forest management activities are having an adverse effect on smallmouth bass populations.

Johnny darter (*Etheostoma nigrum*) **and Channel darter** (*Percina copelandi*)

Distribution of the Johnny darter includes the Mississippi Valley, Great Lakes drainages, south into North Carolina, Tennessee, Kentucky, northern Alabama, and Mississippi and west into Arkansas and southeast Oklahoma. Within the Ouachita National Forest, it may be found in the Poteau, Ouachita, Glover and Mountain Fork drainages. While wide-ranging and abundant over much of its range outside of Arkansas, it is rather uncommon in Arkansas and is found mainly in creeks and small rivers within the Ouachita Mountains (Robison and Buchanan 1988). It occurs in moderate to high gradient streams where it is usually found in slow current near the edges of pools having sand or a mixed sand and gravel bottom.

Distribution of the channel darter is in two disjunct locations. One center of distribution is the Red and Arkansas River basins in Oklahoma, Arkansas, northern Louisiana, southeast Kansas and southwest Missouri. The other populations are in the lower Tennessee drainage, most of the Ohio River drainage and into the lower half of the Great Lakes basin, and the lower St. Lawrence River drainage. Within the Forest, the species is fairly widespread, particularly in the small rivers. It is typically found in riffles of moderate to swift current over a gravel or rocky substrate. It prefers clear water and a silt-free bottom. In some areas of its range, the channel darter prefers pools and quieter waters (Robison and Buchanan 1988).

These two species were retained as Management Indicator Species (MIS) within the range of the Threatened leopard darter under the Revised Land and Resource Management Plan for the Ouachita National Forest. Sampling for the other stream MIS is conducted by electrofishing, which could cause unacceptable mortality to the leopard darter within its range. The US Fish and Wildlife Service (FWS) and the Forest have been conducting joint range-wide snorkeling and SCUBA surveys for leopard darters since 1992 and permanent sampling sites have been monitored yearly since 1998. In order to avoid a gap in stream MIS monitoring in the Glover and Mountain Fork River drainages, these two species were selected with the monitoring tool being their counts at the permanent leopard darter monitoring sites within the range of the leopard darter. All three darters species are usually located in most transects/sites. Johnny and channel darters generally segregate themselves with Johnny darters over the finer substrates and channels in the larger cobbles. Therefore a shift in numbers of one darter over the other could indicate a shift in habitat conditions. It is likely any shift in habitat conditions would be more readily detected with a species shift than examining only one of the three species and relating population changes to habitat conditions.

Data Source: Data are derived from the permanent leopard darter monitoring sites sampled from 1998 through 2007 conducted by the core leopard darter survey team. While data are available at more sites from data sets dating back to 1992, techniques and darter identifications were not as refined. Individual data sets for the earlier years currently reside with the FWS and when received will be examined to determine if there is a way to extract reliable data from the earlier years. See Appendix for a detailed description of the sampling protocol.

Data are available from 18 permanent leopard darter monitoring sites including the sites where depletion samples are taken. Data are missing from several of the sites for one or more years. Other than one site on the Robinson Fork of the Rolling Fork River, one or both species of

Johnny and channel darters have been recorded in the ten years of permanent transect surveys at all other sites. The five upper Little River sites and the two Robinson Fork sites are outside the Forest Boundary in watersheds without National Forest System (NFS) lands. The Cossatot site is located approximately 10 miles downstream of NFS lands. These sites are included in the analyses to help in the determination of any possible population/habitat shifts.

Population Trends: Johnny darters were counted in two of ten years at only one of the two Robinson Fork sites. They appeared in the permanent transects at the Cossatot site in only 2004 and 2007. They also were not present six of the ten years at 72000/55000 Glover River Crossing site and did not appear in six of eight counts at the Glover River depletion site. Johnny darters were present at the other fifteen sites each year sampled, but often with quite variable counts between the years at the same sites. Table 2.28 displays the number of Johnny darters counted per minute for each site and the total count per year divided by the total count time for that year (Pooled counts/total time).

Table 2.28—Johnny darter counts per minute by site by year

Site	1998 count/min	1999 count/min	2000 count/min	2001 count/min	2002 count/min	2003 count/min	2004 count/min	2005 count/min	2006 count/min	2007 count/min
Robinson Fk @ 85300 Xing	0.0000	0.0000	0.0222	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0444
Robinson Fk @ 86000 Xing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cossatot R @ AR Hwy 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0238	0.0000	0.0000	0.0119
Little R @ OK Hwy 144 bridge	0.0625	0.2143	0.2055	0.3418	0.0278	0.1833	0.0435	0.0323	0.0537	0.1311
Little R @ busted Xing	0.0769	0.4138	0.2414	0.3953	0.3333	0.1500	0.1429	0.1250	0.0833	0.1212
Little R @ Watson Cr	0.0755	0.3284	0.1731	0.1408	0.1127	0.2037		0.2174	0.2188	0.2881
Little R @ 77000/82000 Xing	0.2264	0.1761	0.1348	0.0682	0.1842	0.0638	0.2128	0.0588	0.1304	0.1875
Mtn Fk @ 28800 busted Xing	0.5509	0.1781	0.2192	1.0822	0.4545	0.4390	0.3276	1.3947	0.6792	0.1667
Mtn Fk @ AR Hwy 246 Xing	0.1026	0.0185	1.0645	0.2778	0.1702	0.5435	0.0500	0.6190	0.1667	0.2045
MtnFk @ Weyco rd 30203 end	0.2469	0.0408								0.8462
Mtn Fk @ OK Hwy 4		0.1385	0.4691	1.4638	0.3846	0.7692	0.1639	1.4310	0.2813	0.4844
Glover R above Ark Xing	0.1209	0.0286	0.0811	0.1475	0.2703	0.2059	0.0862	0.1167	0.0667	0.0448
Glover R @ 72000/55000 Xing	0.0000	0.0377	0.0000	0.0000	0.0167	0.0000	0.0159	0.0000	0.0000	0.1746
Glover R @ 53000 Xing (GGate)	0.0533	0.0185	0.0392	0.1235	0.2289	0.1644	0.1310	0.0328	0.0455	0.0000
Glover R @ Glover Xing	0.0088	0.0132	0.0635	0.0417	0.0200	0.1282	0.0976	0.0294	0.0278	0.0857
Eagle Fork @ County bridge		0.2000	0.1739	0.3409	0.4222	0.6364	0.1935	0.4872	0.2439	0.0909
Glover R depletion		0.0000		0.0000	0.0417	0.0000	0.0652	0.0000	0.0000	0.0000
Little R depletion	0.0444	0.0345	0.2692	0.1250	0.1039	0.1343	0.1061	0.3774	0.0299	0.0127
Pooled counts/total time	0.1318	0.1001	0.1747	0.2797	0.1641	0.2022	0.0986	0.2647	0.1133	0.1656

Displayed graphically (Figure 2.30), the outliers in the data set are more apparent. The annual pooled count per minute shows a gradual increase through 2001 (Figure 2.31) and fluctuations since then. However annual pooled values are mostly within the largest 25-75% variance boxes, and thus show little shifts in values. The 2007 count is improved over the 2006 count. The polynomial regression trend line is not significant. The 2001, 2003 and 2005 data show the greatest variance at the 10% and 90% intervals as depicted by the whiskers of the plot with the 2004 data showing the least variance between sites.

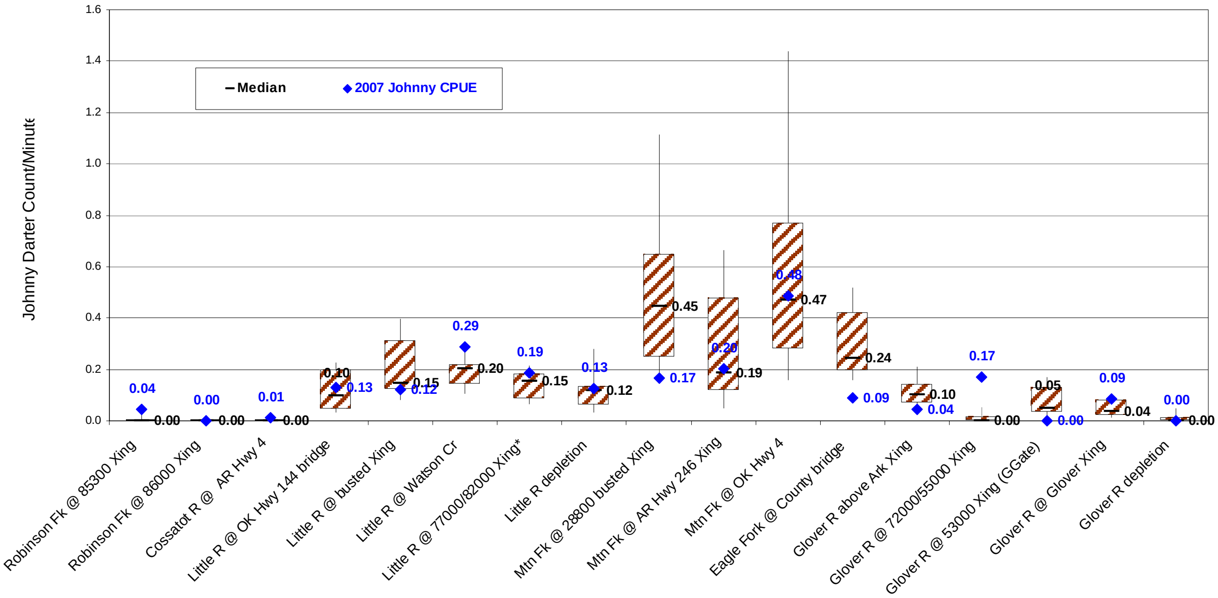

Figure 2.30—Johnny darter counts per minute by site.

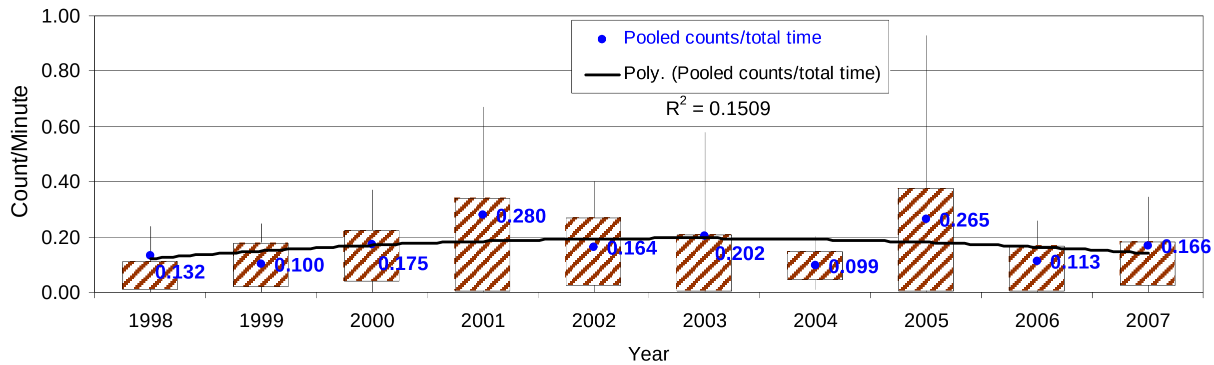

Figure 2.31—Annual pooled count per minute of Johnny darters.

Channel darters have not been counted in the five individual transects at one Robinson Fork site. Channel darters were counted at the second Robinson Fork site in 1998, 2000 and 2007, the middle year being the only one in which Johnny darters were also counted at that site. Channel darters have been noted for the Cossatot site in the shallows, but were only recorded in the permanent transects in 2002. Channel darters were found at all other sites during all years except for the Highway 4 site on the Mountain Fork in 2003, the Little River site at Highway 144, the Arkansas Crossing (natural ford) on the Glover in 2004 and the 53000 crossing on the Glover in 2005. Channel darters were missing from transect counts at two locations in 2007. These include one Robinson Fork site, and the Cossatot site. Table 2.29 displays the channel darters counted per minute for all sites and the total annual count per year divided by the total count time for that year (Pooled Counts/Total time).

Table 2.29—Channel darter counts per minute by site by year

Site	1998 count/min	1999 count/min	2000 count/min	2001 count/min	2002 count/min	2003 count/min	2004 count/min	2005 count/min	2006 count/min	2007 count/min
Robinson Fk @ 85300 Xing	0.0769	0.0000	0.0444	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0222
Robinson Fk @ 86000 Xing	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cossatot R @ AR Hwy 4	0.0000	0.0000	0.0000	0.0000	0.0139	0.0000	0.0000	0.0000	0.0000	0.0000
Little R @ OK Hwy 144 bridge	0.0893	0.1339	0.1233	0.4177	0.1250	0.3167	0.0000	0.1290	0.1607	0.1803
Little R @ busted Xing	0.2115	0.7069	0.2931	0.1860	0.4203	0.2000	0.1429	0.1250	0.2083	0.2424
Little R @ Watson Cr	0.0189	0.6866	0.0962	0.1690	0.1690	0.2963		0.3478	0.1250	0.6610
Little R @ 77000/82000 Xing	0.1887	0.7042	0.1461	0.2841	0.1711	0.1064	0.1489	0.0784	0.2609	0.6667
Mtn Fk @ 28800 busted Xing	0.5090	0.0548	1.3288	0.2192	0.3117	0.1951	0.5000	0.3158	0.0396	0.2708
Mtn Fk @ AR Hwy 246 Xing	0.1538	0.0926	0.2097	0.1852	0.0638	0.2609	0.1500	0.0476	0.1875	0.0682
MtnFk @ Weyco rd 30203 end	0.5556	0.1633								0.2308
Mtn Fk @ OK Hwy 4		0.1385	0.2716	0.2754	0.3846	0.0000	0.0656	0.1207	0.1250	0.1094
Glover R above Ark Xing	0.2747	0.3619	0.6486	0.4590	0.2973	0.1176	0.0000	0.0167	0.0500	0.1045
Glover R @ 72000/55000 Xing	0.0141	0.5472	0.0978	0.0893	0.2000	0.0167	0.1111	0.0333	0.0217	0.1429
Glover R @ 53000 Xing (GGate)	0.0267	0.2500	0.4412	0.4815	0.1928	0.0274	0.0952	0.0000	0.0152	0.0441
Glover R @ Glover Xing	0.1754	0.0263	0.1746	0.0417	0.1400	0.0256	0.1707	0.0588	0.0000	0.1143
Eagle Fork @ County bridge		0.0200	0.0870	0.1364	0.0444	0.0455	0.0968	0.0769	0.0000	0.1515
Glover R depletion		0.5957		0.1852	0.0833	0.0000	0.0652	0.0263	0.0000	0.0278
Little R depletion	0.0667	0.0345	0.0769	0.0694	0.1818	0.0746	0.0909	0.3774	0.1194	0.1111
Pooled counts/total time	0.1825	0.2708	0.2690	0.2030	0.1714	0.0967	0.0964	0.0736	0.0917	0.1667

As seen graphically (Figure 2.32), channel darter counts seemed to have more outliers when compared to Johnny darter numbers (Figure 2.30) even taking y-axis scale differences into consideration.

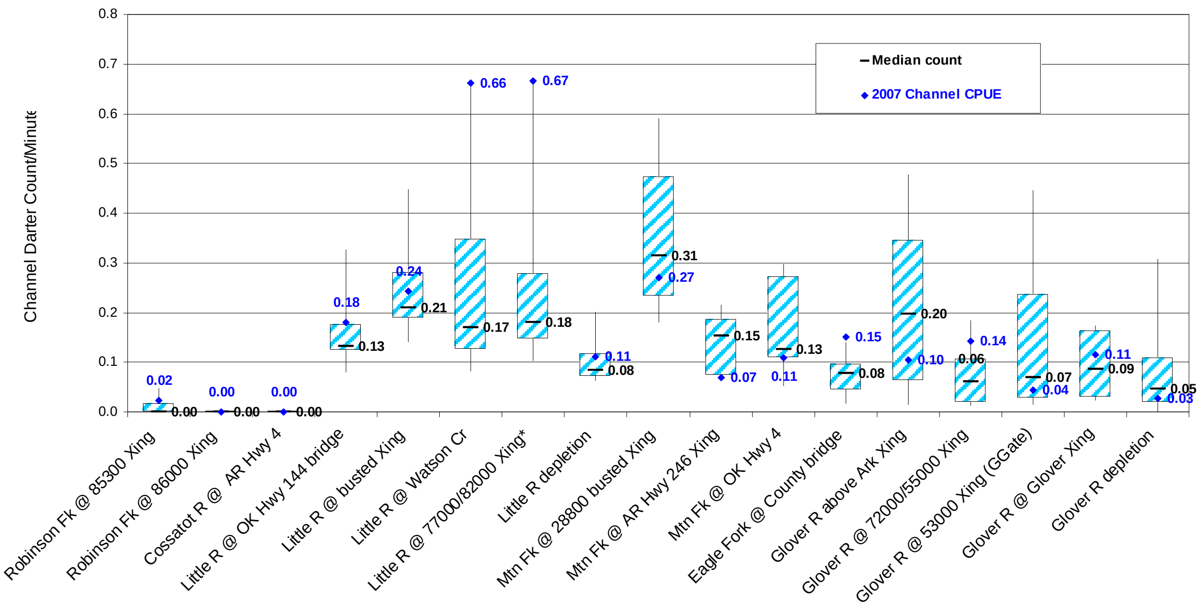

Figure 2.32—Channel darter counts per minute by site.

The channel darter counts, as annual averages (pooled counts/total time), peaked in 1999-2000 then generally declined to a low in 2005 with a slight improvement in 2006 and a greater improvement in 2007. The polynomial regression trend line is of very low statistical significance. The yearly averages for the past four years, as seen in Figure 2.33, are all within the 25-75% variance box of 2003. These boxes are generally similarly sized and positioned with the exception of the much wider range of values in the 1999 data. The range of values for 1998, 2001, and 2002 are also quite similar. While the 2005 pooled count/total time is the lowest, the total variance “box and whiskers” is similar to 1998, 2001 and 2002. The 10-90% data range for 2007 is only exceeded by the first three years and is greater than the preceding four years.

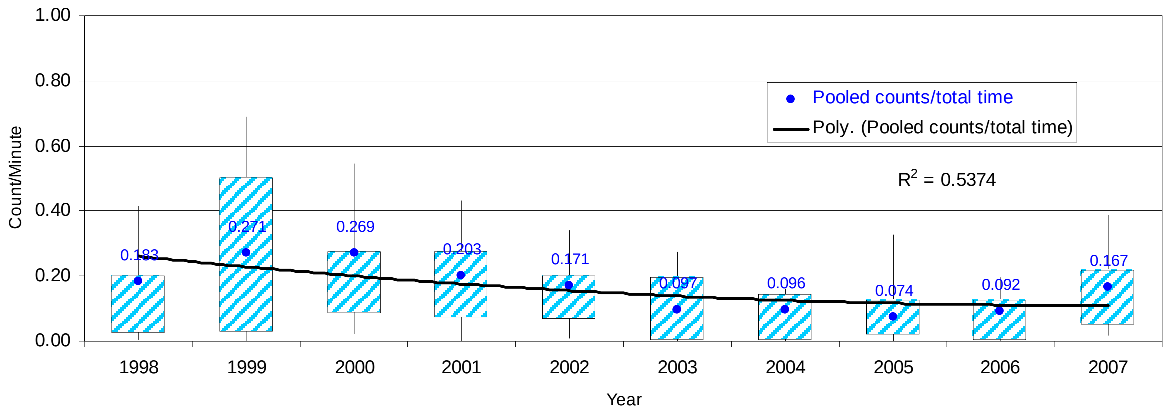

Figure 2.33—Annual pooled count per minute of channel darters.

Because of the difficulty of distinguishing Johnny darters from channel darters under the best of water clarity conditions, we examined the combination of both counts by site (Figure 2.34) and by annual averages (pooled counts) (Figure 2.35). Outliers are again obvious in the combination counts by year with three Mountain Fork sites and two Glover River sites showing the most variation in counts (Figure 2.34). Counts in 2007 in comparison to the median counts for each site showed nearly as many sites up (9) as down (7) in 2007 with one site the same as the median.

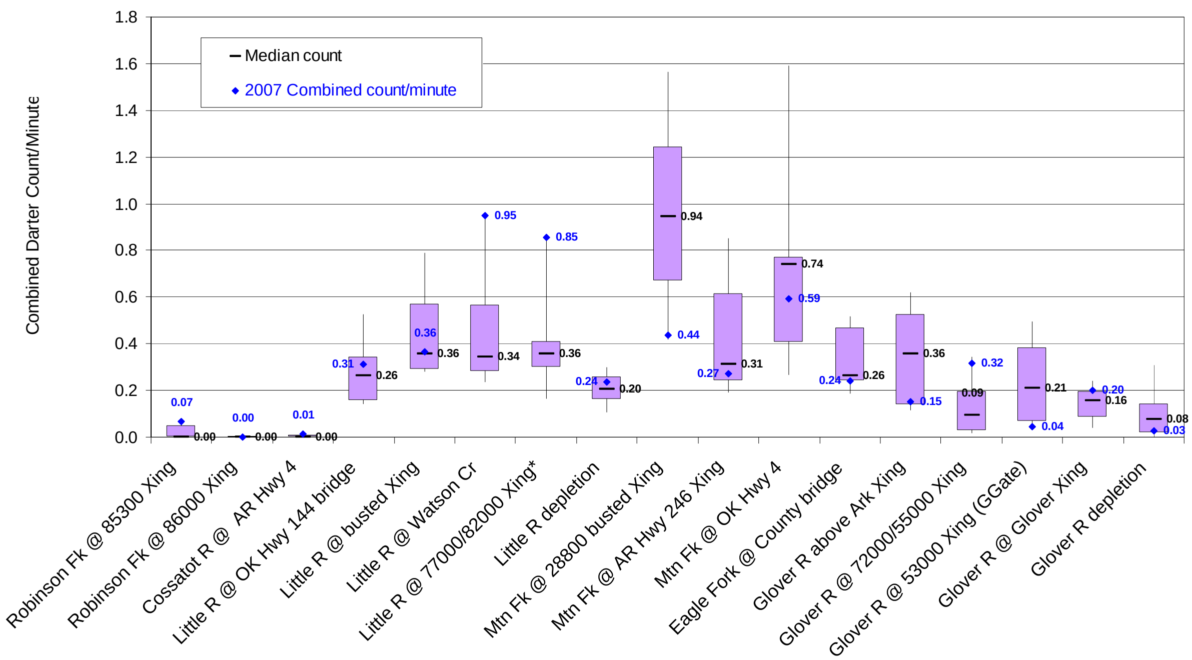

Figure 2.34—Combined counts of Johnny and channel darter per minute by site.

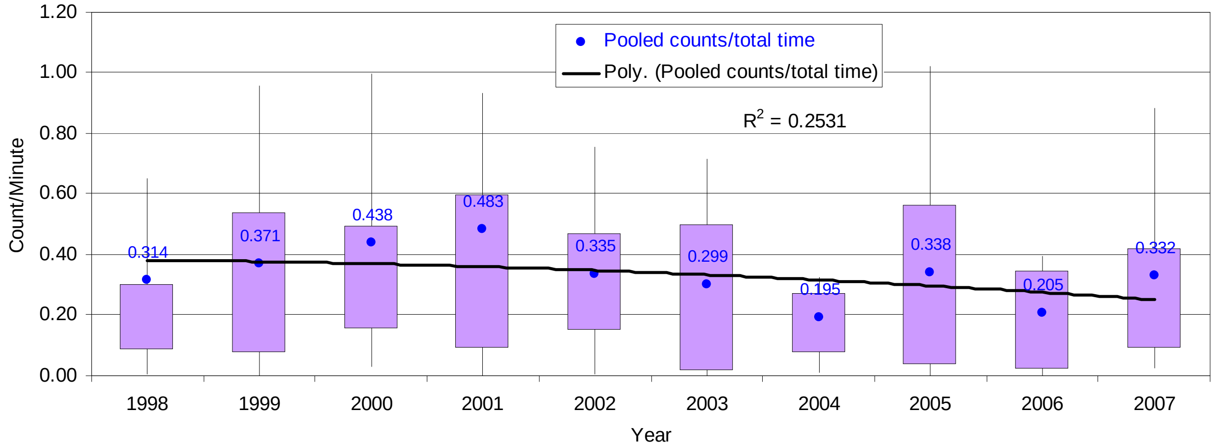

Figure 2.35—Annual combined counts per minute of Johnny and channel darters.

Only a slight increase in combined pooled darter count per minute occurred from 1999 through 2001 and then a drop in 2002 to 2004 with an increase in 2005, another drop in 2006 and an increase in 2007 (Figure 2.35). The polynomial regression trend-line, which turns downward in 2001, is not statistically significant. The year 2004 shows the least variance between site counts of all the prior years and 2005 show the most variance between sites. The year 2007 shows the fifth least amount of variance.

The counts of Johnny and channel darters on a pooled annual range-wide basis (Figure 2.36) indicate that a shift in dominance of channels to Johnny darters occurred between 2000 and 2001. Other than the 2002 counts, Johnny darters have maintained their dominance in the counts until 2007.

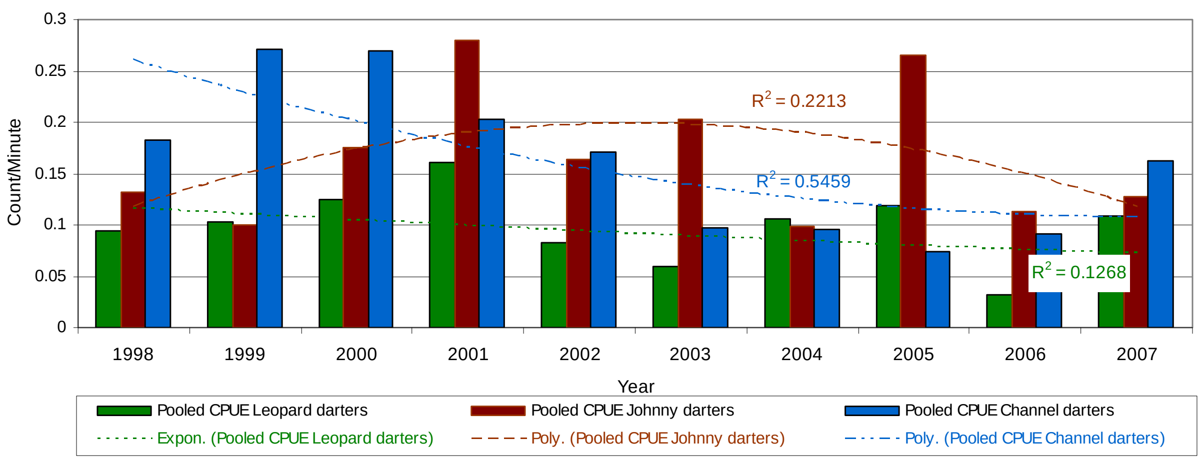

Figure 2.36—Annual counts per minute of leopard, Johnny and channel darters range-wide

Leopard darter pooled counts per year have shown a trend more similar to that of the Johnny darters even though their habitat preference is more similar to that of channel darters.

Interpretation of Trends: It appears that numbers of both darter species fluctuate annually. Part of this variability may be the result of the difficulty in distinguishing the two species, but given the experience level of the snorkeling team, this is at most a minimal factor. It is also not the sole factor as the combined counts also fluctuate. The greatest variances occur with channel darters in 1999 and 2000 and for Johnny darters in 2001, 2003 and 2005. The years 1999 and 2004 had the coolest temperatures and the highest turbidities as we sampled following major rain events both years. However in 2001 we experienced average water clarities and temperatures. In 2003 there were no high winter/early spring flood flows to clean spawning substrates and it was a very droughty year so low reproduction and survival would be expected to carry into 2004. During 2005 there were a couple of moderately flushing flows in January and February but then few sizeable storms the remainder of the year. Substrates observed during 2005 surveys were in some of the worst conditions seen since the start of these surveys with significant quantities of fine sediment and detritus found. Very high counts of Johnny darters were made at the Highway 4 crossing of the Mountain Fork and at the 28800 "busted crossing" on the Mountain Fork in 2005. The Highway 4 crossing is dominated by a bedrock flat and gravel bars making it more attractive for Johnny darters with their preference for finer substrates. Also under drought conditions the flows/current would be less which seems to suit Johnny darters better. The winter of 2005/2006 was wet with numerous spates that cleaned substrates but it was followed by an even dryer summer setting numerous low flow records. The 28800 "busted crossing" had much of the old concrete ford removed following the 2003 survey and the river has been down cutting through the former crossing. Originally the survey transects started immediately upstream of the low water crossing. However with the down cutting, three of the five transects have been moved upstream to access water deep enough to snorkel. As a result, the transects had to be moved out of larger substrates into finer depositional material resulting from the former backwatering of the crossing. This has resulted in habitat shifts that more favor the Johnny darter. The extraordinary 2005 counts from these two sites overshadow the Johnny darter counts for all the other sites.

The trend line for Johnny darters since 2001, while not statistically significant, shows a decline in numbers until the high counts of 2005 and then shows a sizeable drop in 2006 with some rebound in 2007. The trend line for channel darters shows a decline but is only slightly statistically significant. There is a slight rebound in channel darter pooled counts/total time in 2006 and a larger rebound in 2007. The trend line for the combined species is not statistically significant. However, the pooled counts/total time for the combined species counts and the 25-75% variance boxes for the combined counts/minute closely fall within the range of individual years for the ten-year period. The indication is that the variance between sites and between river basins is greater annually than a downward trend in these darter numbers in the five river drainages, if a trend is even occurring.

As seen in Figure 2.36, a waxing and waning of all three species seems to occur range-wide. Examining the data at the river drainage level shows that beginning in 2001, Johnny darters began dominating the Mountain Fork counts and the same year a decline in the predominating channel darter counts in the Glover River began that culminated in 2004 when counts for both species in both of these watersheds were nearly equal. However, in 2005, Johnny darters numbers soared in the Mountain Fork (seven-fold over channel darter counts) and channel darters in the Glover rebounded six-fold over Johnny darter counts. For the Cossatot and Robinson River Drainages these species counts have generally been zero. Counts for both species have shown less variance in the Little River drainage with usually about .05 darters/minute separating the species. Channel darters have been slightly more prevalent in six of ten years. In 2007 Little River channel darter counts were over double that of Johnny darters after a steady increase from 2004.

Range wide, leopard darter annual pooled counts (Figure 2.36) peaked in 2001, declined in 2002 and 2003. In 2004, the leopard darter annual pooled count nearly approximated the 2004 counts for Johnny and channel darters. Leopard and Johnny darters showed increases in 2005 while channel darters showed a decline. In 2006 the leopard darter and Johnny darter numbers plunged while channel darter numbers came up. In 2007 leopard darters made significant gains as did channel darters with Johnny darters only slightly improving above 2006 levels. It would appear something happened between 1999 and 2001, between 2002 and 2003 and again between 2004 and 2005 that gave Johnny darters an "edge" over the other two darter species, however that edge was lost between 2006-2007 when leopard and channel darter numbers increased dramatically. The spring of 2007 was quite wet and flows were sustained much later into the summer than had been experience in the previous few years. These fluctuations in changing species dominance and pooled counts annually are likely drought and/or flood related with spawning/ recruitment timing playing a role. The Tulsa Endangered Species Office of the US Fish and Wildlife Service has contracted for climatological and hydrological data to help answer this question but has not released any analyses to date.

In summary, the populations of Johnny and channel darters (as well as leopard darters) exhibit high variability among years and sites. Variability is thought to be due to temperature, water clarity, drought and the frequency and timing of floods with regard to spawning and recruitment of young into the populations.

Consequences for Conservation of the Species: Populations of both Johnny and channel darters appear quite robust. Viability of neither species is in question.

Implications for Management: As the FWS and Forest continue to work cooperatively to collect and analyze historic and current data sets, the MIS analyses for these two species should become more robust. The potential may then be present to look at population levels and trends in National Forest System watersheds versus watersheds in other/mixed ownerships and under different types and intensities of management.

The Little River site, known as the "busted ford" is a tall low water crossing that was breached in a flood back in the mid 1990's. Its breach was widened with heavy equipment in 2000 after that year's site survey to afford better fish passage. Johnny darter numbers climbed in the 2001 survey compared to prior samples (Figure 2.37). Channel darter numbers doubled from 2001 to 2002 and they out-numbered Johnny darters in the 2002 count. Johnny darters continued to drop after 2001 and showed only the smallest of climb in 2007. Channel darters numbers also dropping annually after the peak in 2002 but then showed an increase in 2006 and 2007.

It was speculated that with less flow constriction at the breech, there would be less backwatering above the structure and the areas would start scouring resulting in coarser substrates. With a substrate shift, it was believed that channel darters would replace a portion of the Johnny darter population at the site. This could then validate our assumption that we can detect habitat changes though shifts in species counts for these two darters.

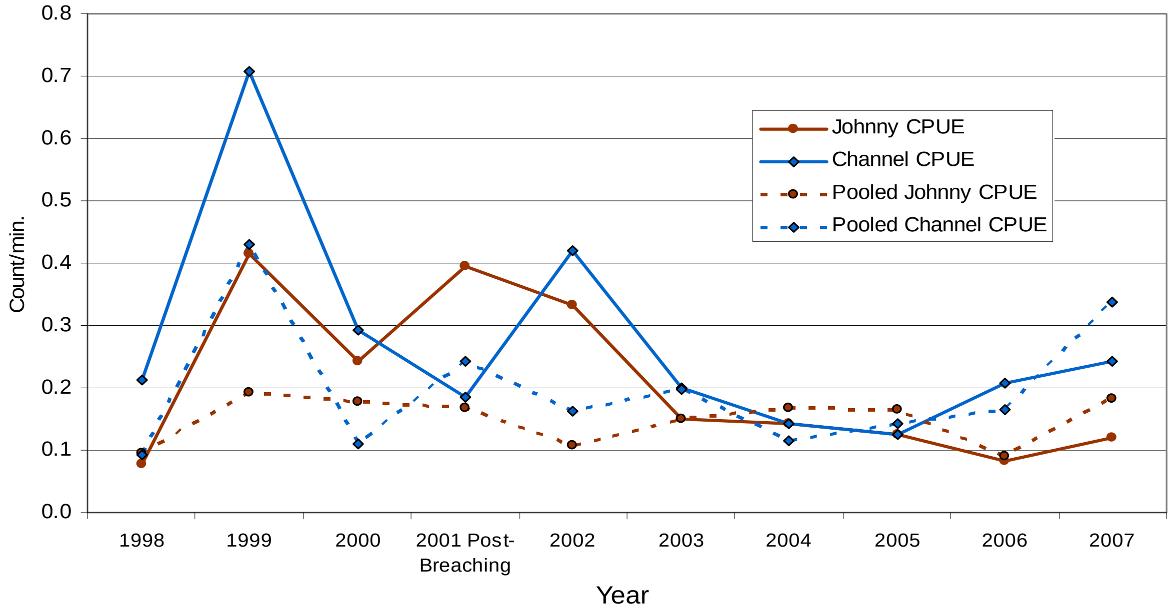

Figure 2.37—Annual counts per minute of Johnny and channel darters at the Little River Busted Ford verse average for remaining sites in the Little River system.

A partial removal of a breached concrete low water crossing on the Mountain Fork River (Road 28800 “busted ford” crossing) was completed after the site’s leopard darter survey in 2003. This project consisted of removing the cement cap on the low water crossing and broken up concrete and imbedded logs were also removed from the original breech to allow the river to continue to down-cut. This work has dropped the upstream pool elevation by at least a foot whereas the breech at the Little River site has not had as notable an effect on the upstream pool’s elevation. Johnny darter counts at the Mountain Fork site (Figure 2.38) initially dropped slightly and then soared in 2005 while channel darter counts more than doubled in 2004 but then dropped in 2005, but to a level still higher than that in 2003 (pre-project). The Johnny darters count dropped by nearly half in 2006 from the 2005 high whereas the channel darter count made nearly a 25 percent increase. In 2007, channel darters dropped below the 2005 level and Johnny darter numbers dropped to below the lowest levels pre-removal. These drops for both species were contrary to improvement in counts at the remaining Mountain Fork sites pooled for 2007.

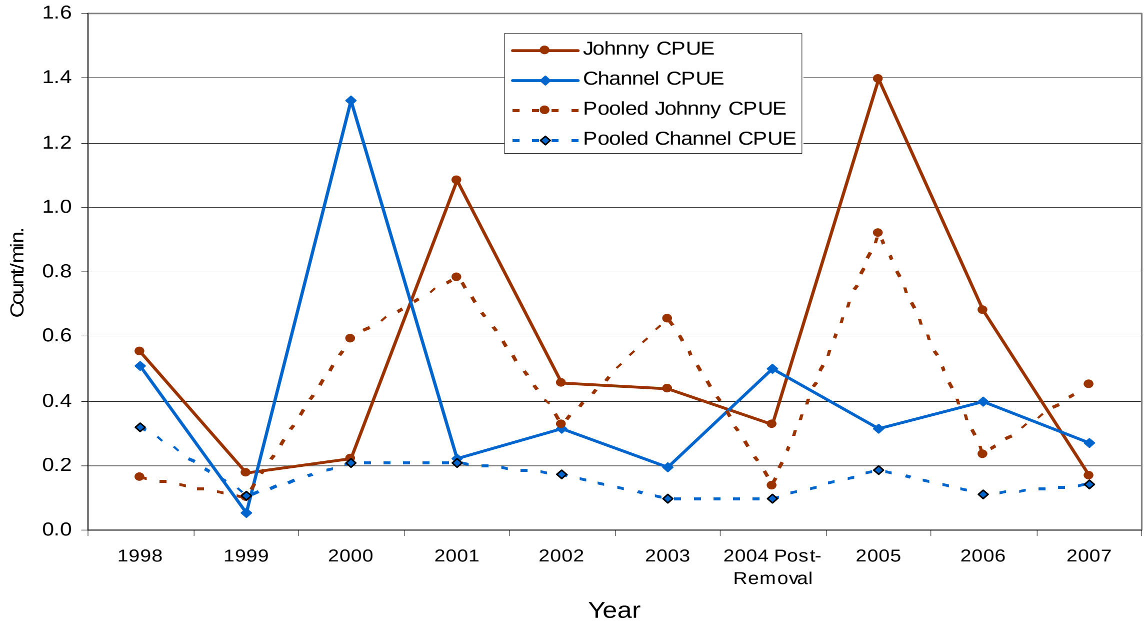

Figure 2.38—Annual counts per minute of Johnny and channel darters at the Mountain Fork Busted Ford verse average for remaining sites within the Mountain Fork system.

When responses of Johnny and channel darters did not appear consistent between the two sites pre- and post-breeching, the analysis was expanded to compare darter counts before and after at each site against the pooled counts of the remaining sites within their respective watersheds.

In 2007, Johnny and channel darters counts/minute increased at the Little River Busted Ford site but at a lower rate than the increase in the remaining drainage counts/minute. At the Mountain Fork Busted Ford site, both species decreased while the remaining Mountain River sites showed an increase. While the ups and downs of these two darter populations at the pooled Little River and the pooled Mountain Fork sites appear somewhat consistent through the years, there is less consistency between the two species counts at the two busted ford sites.

Examination of the data in light of pooled counts of the two darter species at the remaining sites in their respective drainages indicates the variability in these counts at the drainage level may be at least as significant as that caused by the habitat modifications at the two individual sites. Additionally, given the years it has taken for the fords to accumulate the deposited materials upstream, four to seven years may be an insufficient time period for significant change to appear. Darter trends specific to these two fish passage enhancement projects will continue to be examined.

At this time there does not appear to be a need for changes in land management activities related to protecting or enhancing populations of these two MIS.

Chapter III: Lake and Pond Fishes

Lentic fish species are those found in non-flowing water such as lakes, ponds and reservoirs. In the previous Forest planning process, seven species were selected as management indicator species for the lakes and ponds. They were: golden shiner, channel catfish, redear sunfish, black crappie, white crappie, bluegill and largemouth bass. All but the golden shiner were selected because they are sought-after demand species and represent recreational fishing opportunities. The golden shiner was selected, as it was believed to be an important prey species for the demand species. Following analyses of the data for these species, it was determined that golden shiner, channel catfish and black and white crappie did not appear in the samples in suitable numbers across the Forest to serve a useful purpose for showing species and/or habitat trends across the Forest. Subsequently, these species were dropped from the MIS list by amendment to the previous Amended Forest Land Management Plan (Forest Plan). Largemouth bass, bluegill and redear sunfish were retained as MIS in the Revised Land and Resource Management Plan for the Ouachita National Forest (2005).

Monitoring results that would initiate further evaluation are a significant deviation from projected outputs (standing crop or biomass, or species composition), declining populations, or degraded water quality or habitat. The sampling methods are only designed to provide indices of standing crop and species composition. Lake draining or fish toxicant application and collection and enumeration of all fish are the only methods that will give direct estimates of standing crop or biomass of lakes and ponds. Because these methods would result in the recreational fisheries being lost for several years in the ponds and smaller lakes and the lack of suitable coves in the larger lakes for cove sampling, these methods have not been used on the Ouachita National Forest.

Boat electrofishing of lakes and ponds and shoreline seining for bass and sunfish (bluegill predominantly) are the methods currently used to sample lentic fishes. The Forest Fisheries Biologist generally electrofishes 10 to 20 lakes and ponds on the Forest on an annual basis. A more detailed description of these techniques can be found in the appendix to this report.

The electrofishing database consists of 253 lake and pond samples from 1991 through the fall of the year 2007 and contains just over 32,000 fish records. Four small ponds previously sampled have been taken out of these analyses due to the ponds no longer being managed for mixed game fish species but rather put and take channel catfish, or are no longer in National Forest System lands. All fish stunned during electrofishing are collected regardless of species or size. All collected fish are recorded by species, length and weight. Data are entered into a program written by the Arkansas Game and Fish Commission, and computer-generated charts and figures are produced.

These data sets have been used annually in preparation of the Ouachita National Forest's Annual Monitoring and Evaluation report. Most previous analyses have been on a water body by water body basis, which is the appropriate scale for determining management needs. In this report, data are primarily pooled to present results across the Forest to indicate the effects of forest-wide management on these species.

Redear sunfish (Lepomis microlophus)

Redear sunfish were selected as a MIS due to their desirability as one of the larger panfish species caught across the area. They are classified as a demand species as well as a Recreational Fishing Quality (Lakes and Ponds) MIS.

Data Source(s): The data source for the population trend analyses for this species consists of the lake and pond electrofishing sampling database of 253 lake and pond samples taken from 1991 through the year 2007. See Appendix D for a detailed explanation of methodology, lake sampling schedules and hours of sampling per year.

Population Trends: From 1991 through the year 2007, in 253 lake and pond samples, only 1,081 redear sunfish were captured. They have been captured in 19 of the 21 lakes and ponds sampled to date (Table 3.1). Shady Lake, which had nearly half the Forest's catch of this species in 1993 and 1994, was well known for its ½ to ¾ pound redear sunfish. Unfortunately, Shady Lake was accidentally drained in 1995 when a root wad caught in the gate valve preventing its closure. Redears were restocked when the lake was refilled and they have been slowly regaining their prominence in the lake.

Table 3.1—Redear sunfish catch per hour by year

Lake	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bear Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.00	0.00
Boney Ridge Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.00		0.00		0.00	ns	0.00	0.00
Cedar	ns	40.25	25.02	ns	ns	ns	ns	4.64	5.68	2.56	0.83	0.00	1.00	3.30	4.00	7.18	5.97
Cedar Cr	ns	ns	ns	ns	ns	ns	ns	ns	ns	1.05	0.00	2.01	2.00	ns	26.30	8.55	5.10
Cove	ns	0.00	4.65	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	ns	0.00	0.00	ns
Crooked Br	ns	0.00	0.00	0.00	0.00	0.00	12.81	20.40	19.67	65.55	31.08	22.48	16.00	ns	23.90	26.58	13.29
Dry Fork	ns	ns	0.00	1.14	0.00	0.00	0.00	0.00	1.76	0.00	0.00	0.00	0.00	0.00	1.00	0.00	2.96
Hunter's Pool	116.24	ns	36.64	26.37	37.89	ns	ns	ns	ns	ns	47.16	134.92	84.00	86.80	171.60	70.86	113.54
Huston	ns	1.50	17.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ns	0.00	ns
John Burns Pd	ns	ns	ns	27.27	39.03	5.10	ns	ns	ns	ns	ns	17.17	21.60	ns	ns	ns	7.42
Kulli	0.00	3.43	6.90	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ns	ns	ns	0.00
Little Bear	ns	ns	ns	ns	ns	1.37	0.00	0.00	0.00	ns	0.00	ns	0.00	ns	1.20	ns	0.00
Macedonia Pd	ns	ns	ns	19.08	26.60	2.85	0.00	ns	6.92	13.50	8.30	57.63	11.50	37.40	36.50	28.46	46.50
Midway Store Pd	5.58	ns	ns	30.20	ns	ns	0.00	ns	ns	ns	ns	4.38	ns	ns	0.00	ns	ns
Moss Creek Pd	ns	ns	ns	ns	8.75	13.41	10.80	ns	11.54	6.62	10.01	43.09	55.20	ns	54.50	16.05	55.76
North Fork	ns	1.37	28.73	2.56	10.64	6.18	10.64	ns	24.47	9.87	10.00	14.49	1.00	3.60	4.00	4.31	4.24
Old Forester Pd	ns	ns	ns	ns	ns	ns	ns	ns	0.00	ns	0.00	0.00	ns	0.00	ns	ns	0.00
Rock Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ns	0.00	ns	0.00
Shady Lake	ns	ns	55.38	21.72	ns	ns	ns	ns	0.00	0.00	3.66	16.06	13.20	10.40	26.90	12.00	14.87
Story Pd	ns	ns	ns	ns	0.00	0.00	0.00	ns	5.70	0.00	0.00	ns	6.00	1.60	ns	ns	15.78
Sylvia	0.00	0.00	0.00	0.00	1.76	0.00	0.00	ns	ns	ns	ns	ns	ns	0.00	0.00	0.00	0.00
Annual Pooled Catch/Hour	10.40	7.67	17.49	8.01	6.87	1.54	2.53	1.83	3.48	3.50	4.52	11.24	6.17	5.71	13.95	8.88	12.46

ns = no sample

When the catch of redear sunfish is standardized as a pooled annual catch per sampling hour, the trend of a decreasing catch from 1991 through 1996 can be seen with a major upturn since then, however the polynomial regression trend line fitted to these data is not statistically significant and the variability between lakes and years is high (Figure 3.1). The boxes in the box-whisker plot represent 25-27% of the variability with the lines extending to 10 and 90% of the variability respectively. From review of the catch per hour by lake (Table 3.1 and Figure 3.2), some lakes obviously produce more consistent and larger catches of redear annually.

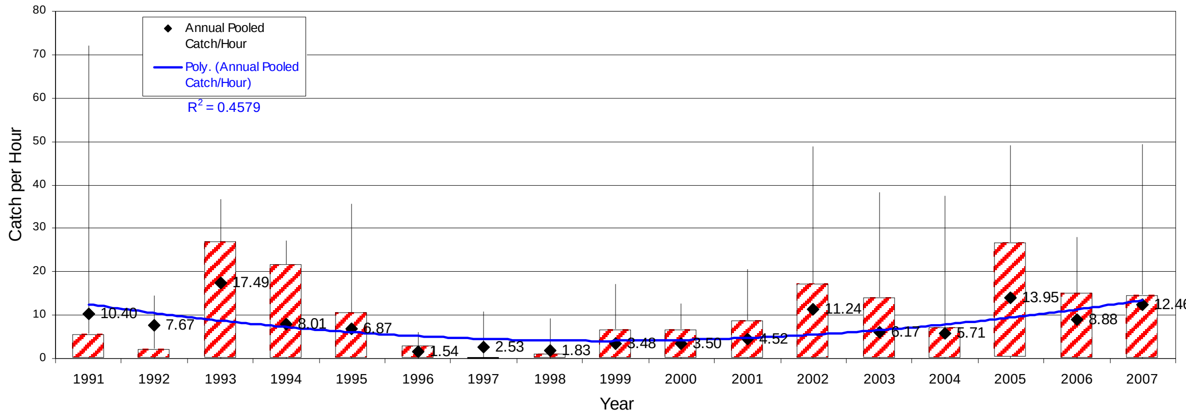

Figure 3.1—Redear sunfish catch per hour by year showing variability of results within each year.

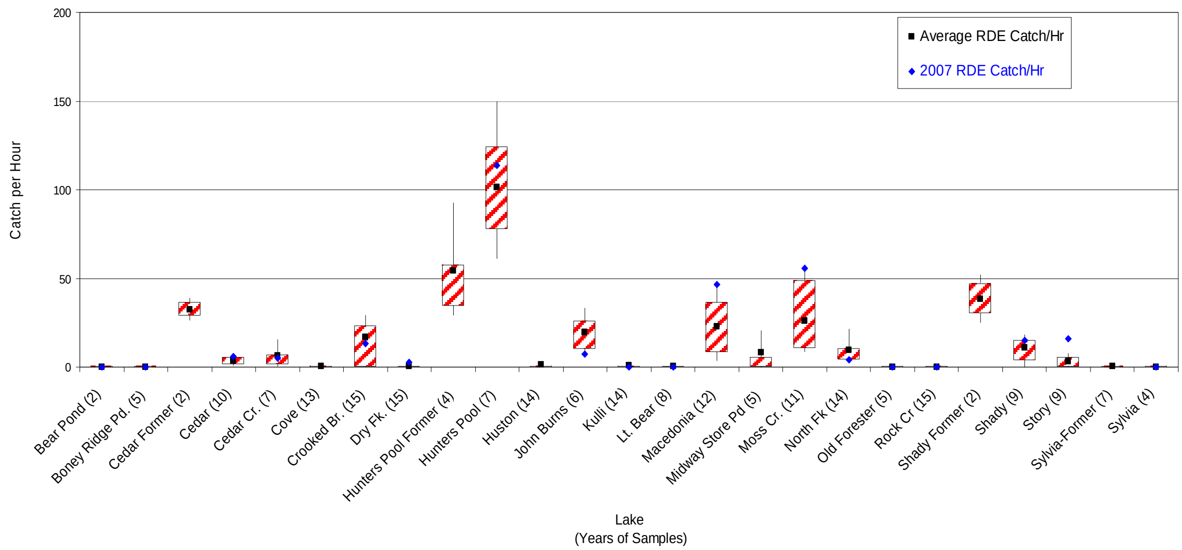

Figure 3.2—Redear catch per hour by lake.

Because redears are sought-after game fish, PSD and PSD-Preferred were calculated by year for the annual catch (Figure 3.3). PSD is Proportional Size Distribution and is a measure of harvestability of the species in the sample catch. PSD for redear uses the stock size of 100 mm (3.9 inches) and the quality size of 180 mm (7.1 inches) and is the percent of stock sized fish that are quality size or larger. PSD-Preferred (formerly RSD) is calculated the same way but uses the preferred size of 230 mm (9.1 inches) (Fisheries 2007). The trends for redear PSD and PSD-Preferred show a general increase through 1997 with a significant drop-off in 1998 (the year with no fall pond sampling) with recovery beginning in 1999. The drop in PSD-Preferred from 2000 to 2002 is attributed to a large catch of young redear sunfish in the newly renovated Hunter's Pool which had the lowest PSD rating of the waterbodies with redear captures in 2001 and 2002. As that population ages, the trend should reverse.

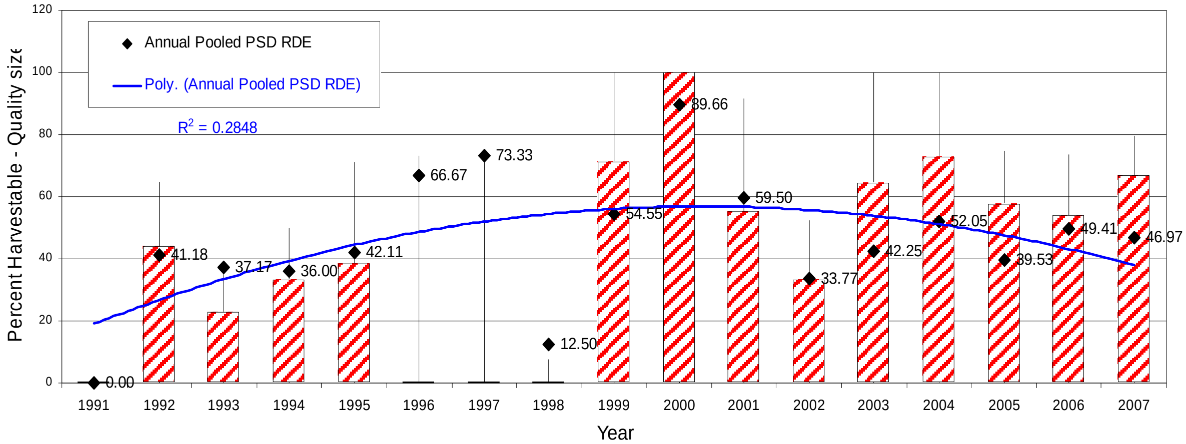

Figure 3.3—Redear sunfish PSD by year.

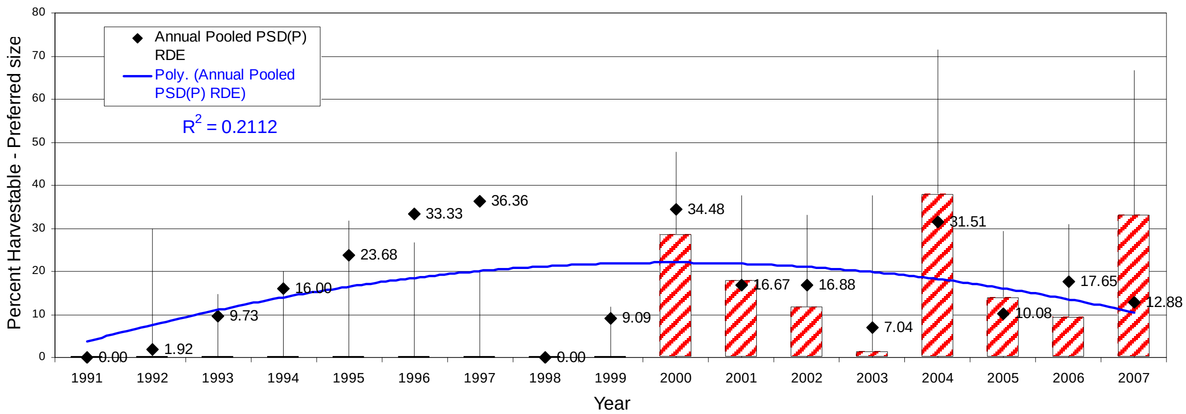

Figure 3.4—Redear sunfish annual pooled PSD-Preferred by year showing variability of results within each year.

Interpretation of Trends: Relatively large catches of redear sunfish were made in Cedar Lake, Hunter's Pool and Shady Lake before their draining and restocking. These earlier populations showed a good size distribution and influenced the moderate PSD levels in the early years. Beginning in 1994, Macedonia Pond, and John Burns Ponds began to have catches of redear sunfish with Moss Creek Pond added in 1995 and finally, Hunter's Pool added back in 2001 after it was rebuilt and restocked. These were newly constructed ponds (Hunter's Pool was actually rebuilt) stocked with redear sunfish with the initial year-class of stocked individuals beginning to show in the early catches. These ponds are also sampled almost exclusively in the fall when the bluegill and redear catch often consists of the largest individuals with a dozen or less coming out of each brush pile in deeper water. In addition, when catches are low in number, the probability of an atypical catch of the larger or smaller-sized individuals in the population increases. This partially explains the increase in PSD and PSD-Preferred in the last couple of years. In 1998, a low annual catch per hour (Table 3.1) and a significant dip in PSD and PSD-Preferred (Figure 3.3 and 3.4) occurred. That year, Macedonia, Moss Creek, Story and North Fork were not sampled in the fall when their redear catches generally make up a significant portion of the Forest's annual catch of the species. The 2001 modest dip in PSD-Preferred and PSD is mostly the result of lower catches in Cedar Lake and Crooked Branch and a fairly significant catch of young redears in Hunter's Pool. The 2002 sample results are also heavily influenced by the large catch of sub-harvestable readears at Hunter's Pool. As the latter pond's redear population ages, the PSD and PSD-Preferred are increasing.

As seen in Figure 3.4, the variability of annual pooled redear PSD is quite high and the polynomial regression trend line is the inverse of the catch trend line (Figure 3.1) but neither the PSD nor PSD-Preferred trend lines are statistically significant (Figures 3.3 and 3.4).

It is expected the modest gains in redear catch per hour in recent years will continue as populations in the recovered and the newer lakes and ponds continue to build. Recent fluctuations in PSD and PSD-Preferred should also moderate as redear populations continue to build and age.

Some fluctuations in catch and harvestability can always be expected as fall samplings of large redears can be hit-or-miss depending upon sampling conditions (temperatures and cold fronts sweeping through) as seen in Figures 3.2, 3.5 and 3.6 respectively. The same is true in trying to catch redear sunfish spawning in the spring in the larger lakes. The smaller ponds with the larger redear populations (including Crooked Branch Lake at only 17 acres, half of which is not sampled due to dense standing timber) tend to show the most variability in catch rates and have the widest variance in harvestability (PSD). Story Pond and Cedar Creek Lake show a slightly different pattern of variability with consistently small catches of redear but high variability in harvestable rates as does North Fork Lake to a lesser extent.

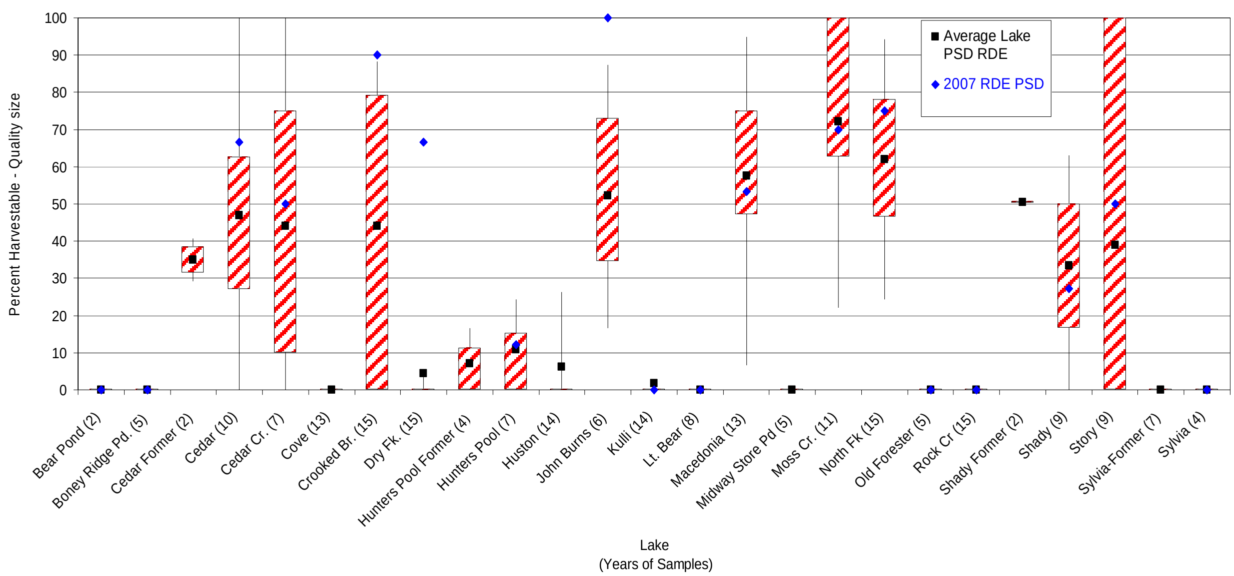

Figure 3.5—Redear sunfish PSD variance by lake by year.

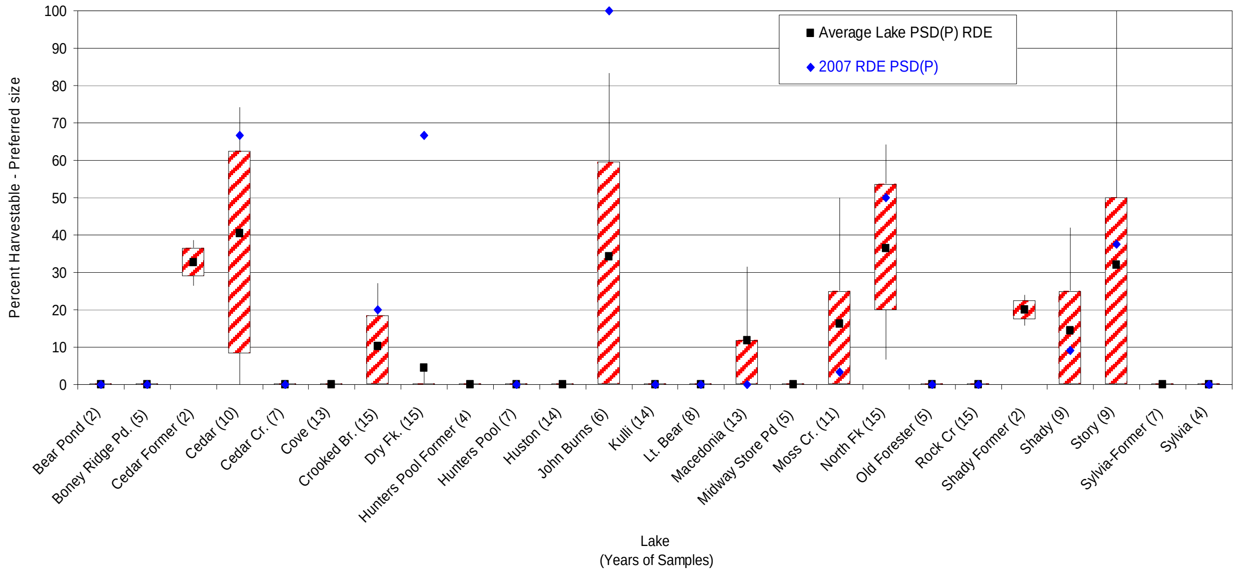

Figure 3.6—Redear sunfish PSD-Preferred variance by lake by year.

Consequences for Conservation of the Species: This species is widely distributed and abundant within the Ouachita National Forest and its viability is not in question. This species is regularly stocked in all new and reclaimed ponds and lakes as a valuable component of the sport fish fishery.

Implications for Management: The species is naturally reproducing in the lakes and ponds where it has been stocked. The species has been stocked in most new waters and populations are building. Because of the nature of this panfish species to reside in deeper water resulting in lower sampling efficiency, populations are likely larger than our sampling would indicate.

Bluegill (*Lepomis macrochirus*)

Bluegill was selected as an MIS because it is a highly sought-after demand species. It is the most abundant game fish in Ouachita National Forest lakes and ponds.

Data Sources: The data source for the population trend analyses for this species consists of the lake and pond electrofishing sampling database of 253 lake and pond samples taken from 1991 through the year 2007. See Appendix for a detailed explanation of methodology, lake sampling schedules and hours of sampling per year.

Population Trends: Bluegill are regularly caught in all lakes and ponds and are represented in all 21 of the lakes and ponds electrofished since 1991 (Table 3.2.). They are by far the most abundant MIS of those selected for lakes and ponds with 13,262 individuals having been caught through 2007.

Table 3.2—Bluegill catch per hour by year

Lake	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bear Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	20.32	7.35
Boney Ridge Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	223.01	ns	216.00	ns	244.70	ns	97.93	39.30
Cedar	ns	186.70	264.50	ns	ns	ns	ns	150.50	397.79	122.81	52.01	54.60	22.00	11.70	46.00	19.95	119.30
Cedar Cr	ns	ns	ns	ns	ns	ns	ns	ns	ns	68.14	28.11	16.15	29.90	ns	63.50	10.26	40.82
Cove	ns	106.30	395.10	39.90	23.20	97.80	43.60	92.50	47.77	ns	42.14	79.03	44.30	ns	94.30	28.89	ns
Crooked Br	ns	174.40	39.60	61.30	36.70	56.50	70.50	61.20	31.48	65.55	51.80	51.38	113.70	ns	105.80	75.95	62.48
Dry Fork	ns	ns	326.60	54.70	16.10	96.80	75.20	88.80	110.96	71.38	51.24	78.72	94.40	2.70	86.90	58.95	78.84
Hunter's Pool	42.30	ns	97.70	23.70	29.50	ns	ns	ns	ns	ns	157.21	441.57	112.00	63.20	356.50	190.76	240.92
Huston	ns	99.00	92.70	33.60	79.50	28.30	18.20	18.10	29.46	23.42	16.17	9.48	7.10	9.80	ns	13.31	ns
John Burns Pd	ns	ns	ns	256.36	348.29	91.78	ns	ns	ns	ns	ns	303.34	167.60	ns	ns	ns	59.32
Kulli	487.50	47.20	365.50	60.30	34.20	368.70	43.20	35.80	29.16	120.15	91.17	69.13	414.80	ns	ns	ns	49.26
Little Bear	ns	ns	ns	ns	ns	89.20	71.70	24.90	13.04	ns	97.55	ns	65.60	ns	31.10	ns	57.80
Macedonia Pd	ns	ns	ns	367.12	351.72	299.29	294.97	ns	136.73	242.92	171.56	244.07	74.70	85.40	109.50	110.99	82.07
Midway Store Pd	8.37	ns	ns	281.83	ns	ns	370.20	ns	ns	ns	ns	0.00	ns	ns	0.00	ns	ns
Moss Creek Pd	ns	ns	ns	ns	341.33	566.42	372.69	ns	123.08	56.30	97.57	86.17	128.90	ns	58.60	40.12	27.88
North Fork	ns	8.24	1254.00	76.80	21.30	96.80	29.27	ns	115.56	36.02	64.03	62.03	33.00	45.30	65.00	37.87	54.31
Old Forester Pd	ns	ns	ns	ns	ns	ns	ns	ns	119.65	ns	108.97	11.84	ns	14.80	ns	ns	55.44
Rock Cr	105.00	76.70	298.10	116.70	62.60	23.10	23.60	12.50	37.36	26.36	11.74	49.10	14.90	ns	44.70	ns	12.83
Shady Lake	ns	251.79	147.98	50.90	ns	ns	ns	ns	3.42	5.54	14.65	29.21	55.20	79.00	93.60	12.00	4.06
Story Pd	ns	ns	ns	ns	492.38	629.47	727.13	ns	1201.90	364.51	729.28	ns	331.90	115.70	ns	ns	52.61
Sylvia	185.00	176.80	162.80	98.10	35.10	49.30	43.30	ns	ns	ns	ns	ns	ns	23.60	107.70	29.60	164.25
Annual Pooled Catch/Hour	195.46	121.19	266.98	86.36	104.25	140.52	123.59	79.75	106.37	77.39	81.14	76.56	67.07	39.32	76.29	42.69	69.25

ns = no sample

Apparent from these data and even more apparent in Figures 3.7 and 3.8, some extraordinarily large catches were made in 1993 representing nearly one-sixth of the total bluegill catch. These 1993 captures were the result of the newly rebuilt boat that greatly increased electrofishing efficiencies and this was the last year of nighttime sampling. After the 1993 season, nighttime sampling was abandoned in favor of less capture-efficient daytime sampling due to safety and logistical concerns. In addition, the lack of fall sampling in 1998 eliminated several of the better bluegill waters from contributing to that year's total. This resulted in the pooled Forest catch statistics being lower that year with less variability (Figure 3.7). Having been rained out of Moss Creek Pond in 2004 contributed to the low overall catch rate for bluegill that year.

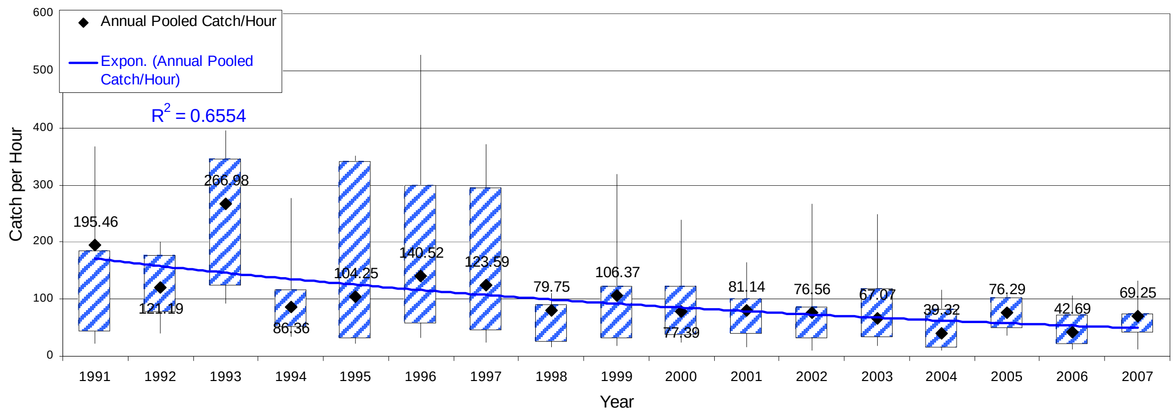

Figure 3.7—Bluegill catch per hour by year showing variability of results within each year.

Aside from the discussion above for the 1993 and 1998 sample years, the annual pooled catch rates show a fair amount of variance and there is a lot of variance among lakes. This is very obvious when individual annual lake catch rates are viewed graphically (Figure 3.8). The trend line of the exponential regression of the annual pooled catch/hour shown in Figure 3.7 depicts a gradual downward trend but its statistical significance is fairly low.

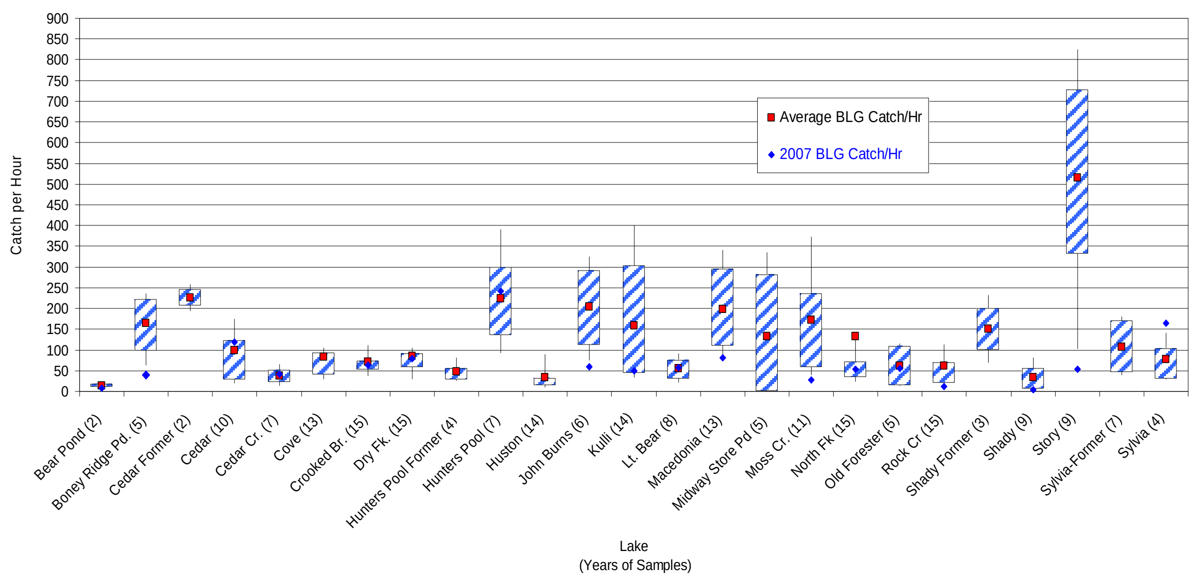

Figure 3.8—Bluegill catch per hour by lake.

As bluegill are a harvested species, values have been developed for calculating PSD and PSD-Preferred. Stock length is 80 mm (3.1 inches) and quality length is 150 mm (5.9 inches) for calculation of PSD and the preferred length is 200 mm (7.9 inches) for calculation of PSD-Preferred. Examination of the PSD and PSD-Preferred data indicates a fair amount of variability (Figure 3.9 and 3.10). The trend in the annual pooled PSD data has been for PSD to increase from 1991 through 2000 with a significant drop in 1998 (the result of the missing ponds as noted above), some recovery in 1999, full recovery in 2000, a very minor dip in 2001 and a larger dip in 2002, minor recovery in 2003, a large jump in 2004 to the highest value recorded then drops again in 2005 and 2006. Further recovery of harvestability occurred in 2007 but some of the greatest variability occurred in 2007. The trend line is not statistically significant. PSD-Preferred has stayed fairly constant throughout the time period with the exception of a jump in 2004 and 2007; however note that the y-axis scale is much smaller for the PSD-Preferred versus the PSD graph. The trend line for percent catch of preferred-sized bluegill is also not statistically significant. A sizeable portion of the quality and preferred sized bluegill catch in 2004 was of large individuals spawning at Cedar and Shady Lakes and large schooled bluegill caught in the fall samples at Moss Creek and Story ponds. Similar large catches in just a few waters heavily influenced the 2007 PSD and PDS-Preferred as seen in Figures 3.11 and 3.12. We experienced a low bluegill catch per hour in 2004 and 2007 which magnified the significance of the larger fish.

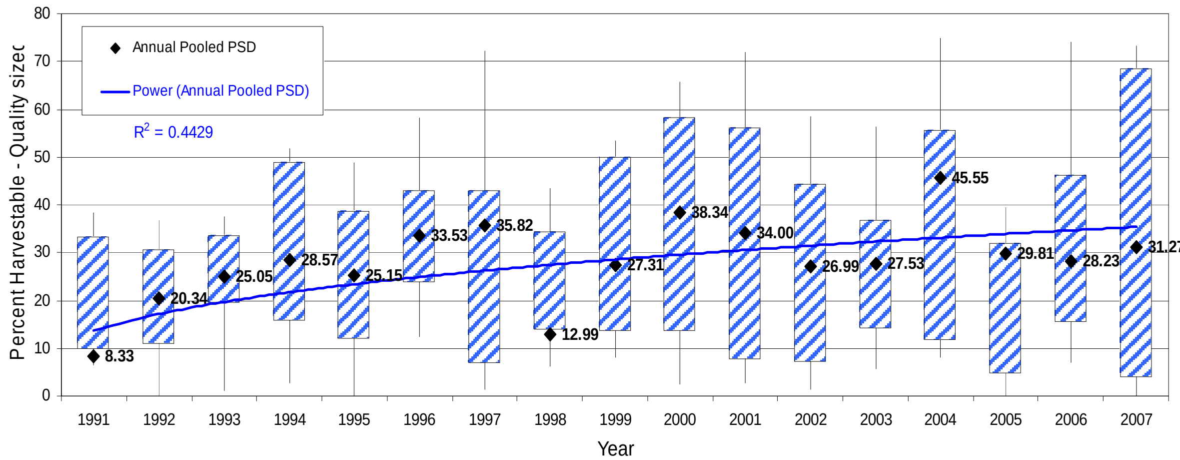

Figure 3.9—Bluegill PSD by year.

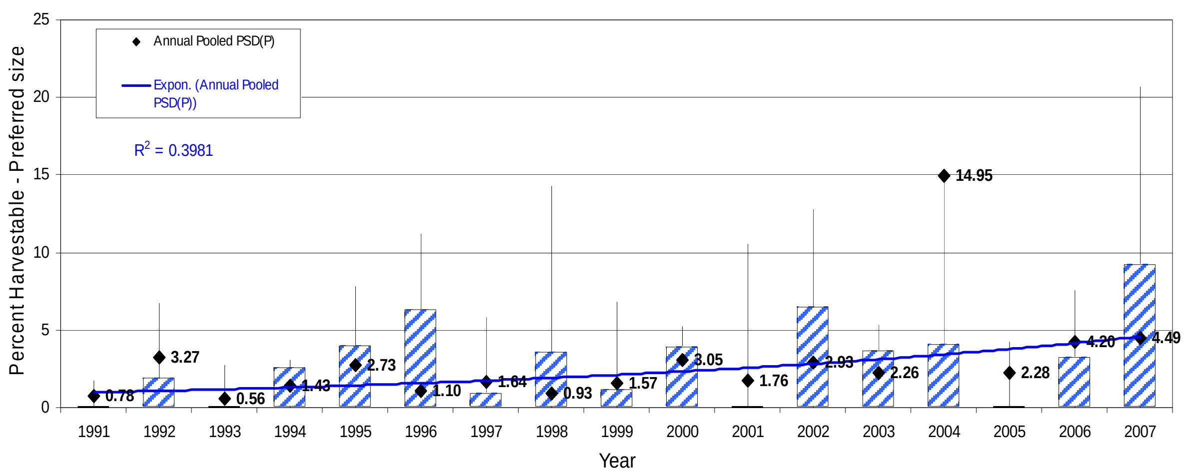

Figure 3.10—Bluegill annual pooled PSD-Preferred by year.

Interpretation of Trends: Sample equipment, timing and the lakes and ponds which are sampled in any given year heavily influence the annual catch rates and sizes of bluegill captured. See Appendix for a detailed discussion of equipment and sampling procedure shifts for the years sampled. While the transitions in sampling times (season and time of day) and equipment were being made, Cedar Lake and Shady Lake, both with good bluegill populations, were drained due to repair needs (or an accidental draining followed by repair work as in the case of Shady Lake) and were taken out of the sampling program for a number of years. The new ponds, Macedonia, Story and Moss Creek, were added to the sampling program as their newly-stocked fisheries developed. These three waters have developed so well that well-balanced bass/bluegill populations and heavy catches of bluegill can be counted on during their fall sampling. In fact, when these ponds were not sampled in the fall of 1998, a noticeable drop in annual catch per hour and harvestability can be seen (Figures 3.7 and 3.10), particularly in harvestability. A certain degree of fluctuation in pooled PSD and PSD-Preferred by year and by individual lakes by year is expected (Figures 3.11 and 3.12).

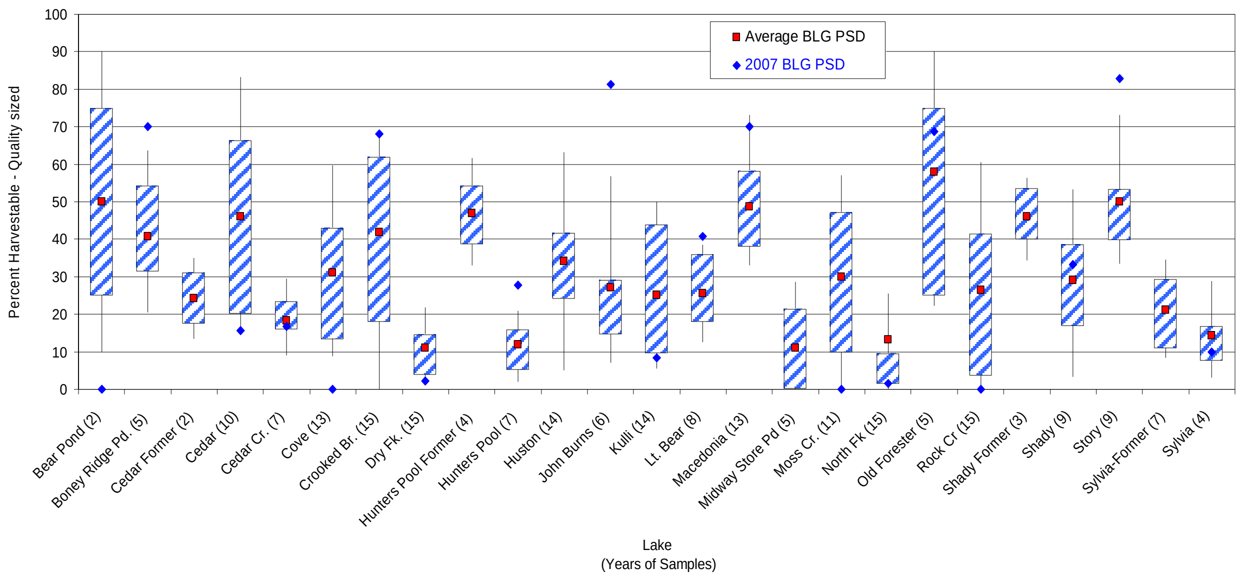

Figure 3.11—Bluegill PSD by lake by year.

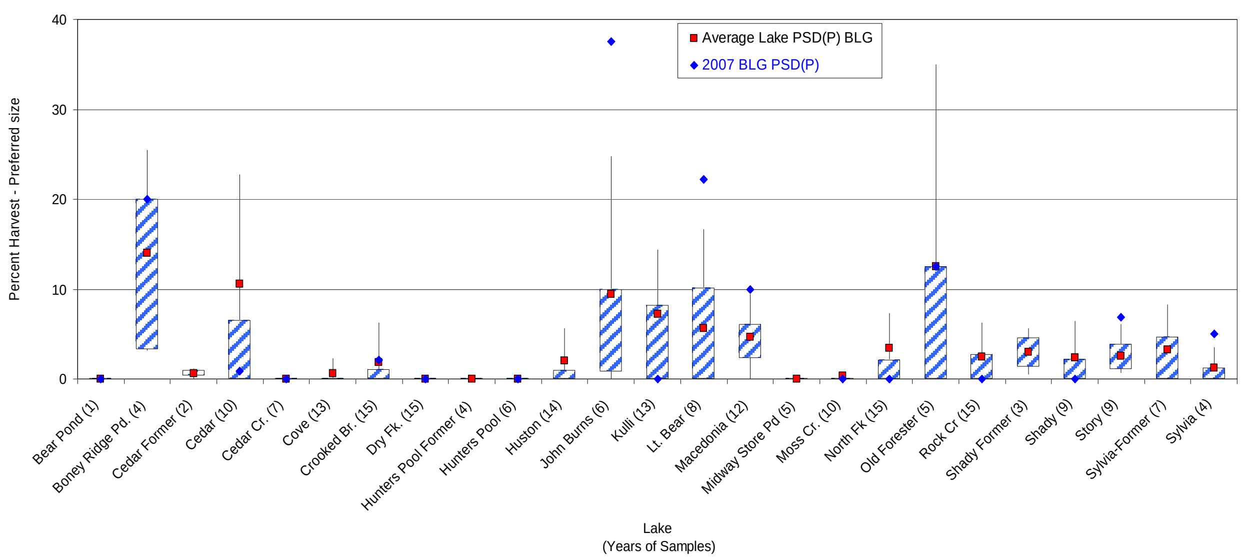

Figure 3.12—Bluegill PSD-Preferred by lake by year.

As with the redear sunfish, the highest variances in catch rates for bluegill generally occur in the smaller ponds.   Harvestability of bluegill shows greater variance in the smaller waters where results tend to be more “hit or miss”.

When taking all of this into consideration, all lakes and ponds appear to be producing bluegill at acceptable levels. Crooked Branch in the first few years sampled appeared to have a stunted bluegill population with high catch rates and extremely low harvestability rates. This situation was corrected with several years of heavy bass stocking using the less angler-vulnerable Florida strain of largemouth bass. This corrective action resulted in increased harvestability rates for the bluegill which resulted in the large variance in harvestability for this lake as seen in Figure 3.11. Overall, bluegill population trends have been pretty stable since 2000. Harvestability of these populations is in the range of expectations. The slight drop in harvestability for 2001 is attributed to high catch rates of young bluegill in the newly rebuilt Hunter’s Pool and somewhat atypical results at North Fork Lake and Story and Macedonia Ponds. These three were sampled using several college field ecology lab classes and between the students’ inexperience and equipment problems, results may not reflect what was really present. Another drop in the annual pooled PSD occurred in 2002 but much of that drop is attributed to not being able to sample Story Pond because the pond was too low to launch the electrofishing boat. The large catches and good numbers of harvestable bluegill caught from this pond annually, when missing, have a depressing effect upon Forest results.   After seeing the small catches of 2004 but high PSD and PSD-Preferred for those years, sample timing was examined and it was discovered that Spring sampling had been creeping to slightly later in the Spring and the Fall sampling had been creeping up. Both resulted in warmer temperatures which in the spring mean catching more of the larger bluegill but in the fall means missing the largest bluegill that begin schooling when the water temperature starts cooling. Beginning with the fall 2005 sampling, fall sample timing was set back in an effort to match previous conditions. Results from the 2005 and 2006 samples, for the most part, show less variability in both catch rates and harvestability for the year and individual waters. The annual catch rate and harvestability for bluegill in 2007 is quite similar to that of four of the last five years but the variability between lakes in 2007 for harvestability of both quality and preferred-sized bluegill was highly variable; in a large part driven by exceptionally large bluegill caught at Boney Ridge, John Burns and Story Ponds.

Consequences for Conservation of the Species: Bluegill are among the most widespread and numerous species found within the Forest’s lakes and ponds. Its viability as a species within the Forest is not in question. This species is regularly stocked in all new and reclaimed ponds and lakes as a valuable component of the sport fish fishery.

Implications for Management: Bluegill fishing opportunities abound across the Forest. However, these opportunities are not equal at all waters. Water body age, rates of inflow and outflow, and whether the waters are being limed and fertilized all have a bearing on bluegill production.   The size and health of the bass population is another factor influencing bluegill fisheries.   A well-structured bass population keeps the bluegill population in balance with its habitat and produces desirable-sized fish. Considering these variables, all populations within the Forest are within expected ranges. The intensively managed Boney Ridge, Macedonia and Story Ponds are by far the best bluegill fisheries on the Forest. Others, such as Dry Fork and the other flood control reservoirs, will produce catchable bluegill but because of low productivity brought on by lake age, high flow through rates and other competing sunfish species, they will never produce bluegill similar to Macedonia Pond without intensive and cost-prohibitive management.

Forest-wide, because of the age of the water bodies being sampled, particularly the aging of the ponds, some decline in number caught per hour and harvestability is expected in the long-term. Current budget levels may not be sufficient to maintain productivity through habitat enhancements.

Largemouth Bass (*Micropterus salmoides*)

Largemouth bass was selected as a MIS because it is a highly sought-after demand species. It is the second most abundant game fish in Forest lakes and ponds.

Data Sources: The data source for population trend analyses for this species consists of the lake and pond electrofishing sampling database of 253 lake and pond samples taken from 1991 through the year 2007. See Appendix for a detailed explanation of methodology, lake sampling schedules and hours of sampling per year.

Population Trends: Largemouth bass are regularly caught in all lakes and ponds and are represented in all 21 of the lakes and ponds electrofished since 1991. They are the second most frequently caught MIS of those selected for lakes and ponds with 10,081 having been caught.

Annual catch per hour suggests an increasing trend in largemouth bass abundance across the Forest (Table 3.3 and Figure 3.13) through about 2002 and then a slight decreasing trend. However, the polynomial trend line is not statistically significant. Results are affected by quite a number of exceptional catches over 150 bass per hour as seen in Figures 3.13 and 3.14.

Table 3.3—Largemouth bass catch per hour by year

Lake	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bear Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	54.19	40.41
Boney Ridge Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	114.69	ns	120.00	ns	67.10	ns	31.34	66.81
Cedar	ns	40.30	57.20	ns	ns	379.54	ns	107.70	173.32	92.11	185.00	248.07	203.00	76.80	223.90	96.54	122.29
Cedar Cr	ns	ns	ns	ns	ns	ns	ns	ns	ns	2.10	7.03	14.04	27.90	ns	54.30	85.51	76.54
Cove	ns	66.70	69.70	49.50	51.50	39.10	45.20	65.20	25.48	ns	64.33	60.31	26.60	ns	44.50	42.03	ns
Crooked Br	ns	1.60	9.30	12.30	16.90	7.70	35.20	56.10	59.02	25.21	36.23	51.38	55.90	ns	29.90	24.68	29.25
Dry Fork	ns	ns	116.60	43.30	31.40	43.50	69.60	58.10	79.26	57.11	47.19	95.77	133.80	17.50	58.90	37.99	48.29
Hunter's Pool	28.20	ns	18.30	5.30	42.10	ns	ns	ns	ns	ns	86.46	134.92	48.00	23.70	57.20	21.80	30.46
Huston	ns	68.30	98.20	29.20	39.70	44.70	58.80	42.10	47.70	45.38	52.33	56.87	28.30	34.20	ns	47.57	ns
John Burns Pd	ns	ns	ns	60.00	138.12	66.29	ns	ns	ns	ns	ns	85.85	48.60	ns	ns	ns	59.32
Kulli	77.30	24.90	110.30	27.60	37.00	122.90	24.00	55.10	25.92	262.27	190.64	215.36	189.60	ns	ns	ns	32.84
Little Bear	ns	ns	ns	ns	66.80	63.10	120.60	61.50	46.36	ns	63.48	ns	34.80	ns	45.00	ns	67.05
Macedonia Pd	ns	ns	ns	112.33	100.49	65.56	572.16	ns	115.96	87.82	99.62	142.37	63.20	82.70	42.10	31.30	41.03
Midway Store Pd	8.37	ns	ns	3.40	ns	ns	15.80	ns	ns	ns	ns	57.00	ns	ns	33.30	ns	ns
Moss Creek Pd	ns	ns	ns	ns	26.26	63.69	45.91	ns	123.08	66.24	70.05	114.89	128.90	ns	62.80	24.07	53.90
North Fork	ns	16.48	216.80	78.00	114.30	125.60	172.95	ns	157.46	64.27	150.35	137.39	113.00	36.30	76.00	55.42	20.03
Old Forester Pd	ns	ns	ns	ns	ns	ns	ns	ns	91.04		89.51	106.58	ns	92.70	ns	ns	76.23
Rock Cr	9.00	55.90	67.90	101.50	64.90	83.60	70.80	39.50	64.98	74.30	52.83	66.96	31.80	ns	44.70	ns	42.78
Shady Lake	ns	141.00	53.65	33.93	ns	ns	ns	ns	42.18	18.82	49.44	33.59	38.40	31.30	57.70	46.67	37.85
Story Pd	ns	ns	ns	ns	115.70	106.09	148.17	ns	461.39	126.96	112.71	ns	113.60	23.80	ns	ns	49.10
Sylvia	60.00	67.90	111.20	171.70	93.10	59.90	60.60	ns	ns	ns	ns	ns	ns	29.00	82.77	39.47	64.21
Annual pooled catch/hour	40.40	48.65	83.21	54.66	63.59	73.86	104.65	70.82	87.18	71.72	94.91	107.46	83.16	49.89	77.44	52.44	50.11

ns = no sample

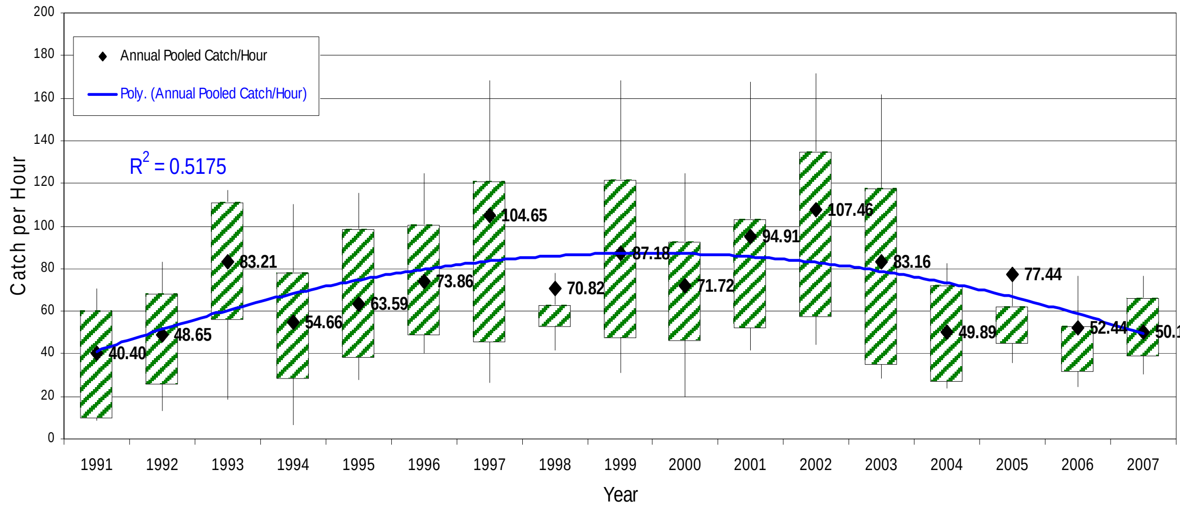

Figure 3.13—Largemouth bass catch per hour by year.

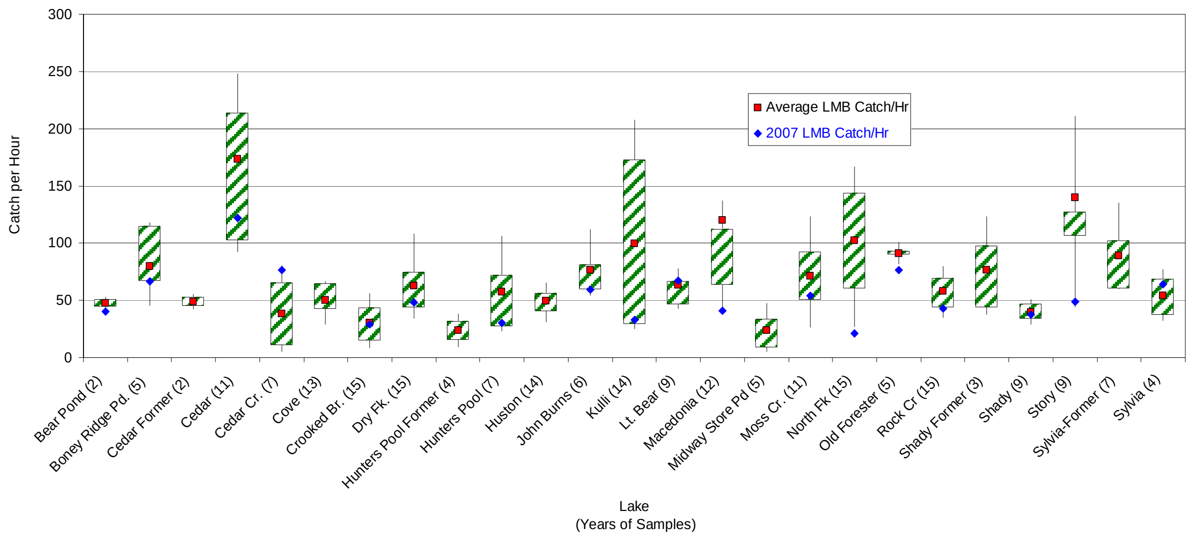

Figure 3.14—Largemouth bass catch per hour by lake by year.

As with the bluegill samples, the lack of 1998 pond samples resulted in a lower annual catch rate for bass that particular year and the 1993 results reflect the increased efficiencies of the then-new electrofishing boat and the last year of the more efficient night-time electrofishing. The polynomial trend line (Figure 3.13) shows an increasing trend in bass capture per hour through 1999 but then a downturn driven by low catches in 2004, 2006 and 2007. However, the trend line is only slightly statistically significant and the variability plots show a great deal of overlap. The 2002 annual pooled catch per hour is the highest ever with nearly half the lakes and ponds having capture rates over 100 bass per hour whereas the high annual pooled catch rate for 1997 is driven by the exceptional catch of over 550 bass per hour at only one pond (Macedonia at 572.16 bass/hour). Abnormally low catches in Story Pond in 2004 and 2005 contributed to the downturn in catch per hour for these two years. Abnormally low catches of bass per hour in Cedar Lake and Moss Creek Pond pulled down the 2006 annual pooled catch rate. Timing issues with being a bit too early sampling Cedar Lake and a weather front coming through at Moss Creek Pond were believed the major contributing factor to those low catch rates. During 2007, most bass catch rates were lower nearly across the board which would indicate less a weather front or temperature issue but possibly a drought impact. This bears watching.

As largemouth bass are a harvested species, values have been developed for calculating PSD and PSD-Preferred. Stock length is 200 mm (7.9 inches) and quality length is 300 mm (11.8 inches) for calculation of PSD and the preferred length is 380 mm (15 inches) for calculating PSD-Preferred. Examination of the PSD and PSD-Preferred data indicates a fair amount of variability (Figure 3.15, 3.16, 3.17 and 3.18). The overall trend is for PSD to gradually increase from 1991 with a polynomial trend line of fair statistical significance. PSD-Preferred does not show a statistically significant trend. PSD for 2001 is quite high, mostly the result a spectacular catch at Cedar Lake of 73 bass over 12 inches and 15 over 13 inches in length. With the very high bass catch rates at Cedar Lake, it's PSD and PSD-Preferred values have a major effect on the Forest's annual pooled catch PSD and PSD-Preferred values for that year.

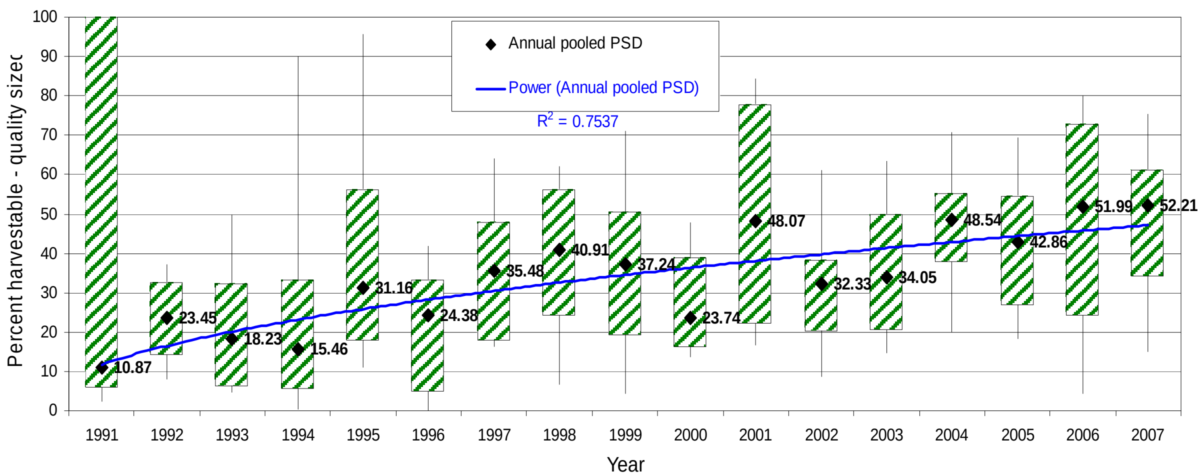

Figure 3.15—Largemouth bass PSD by year

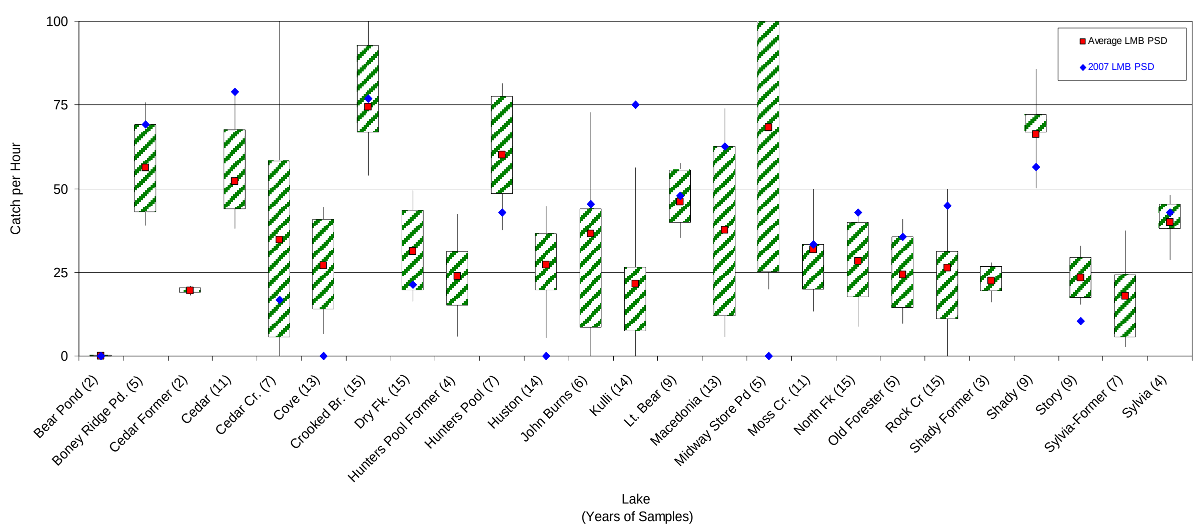

Figure 3.16—Largemouth bass annual pooled PSD by lake.

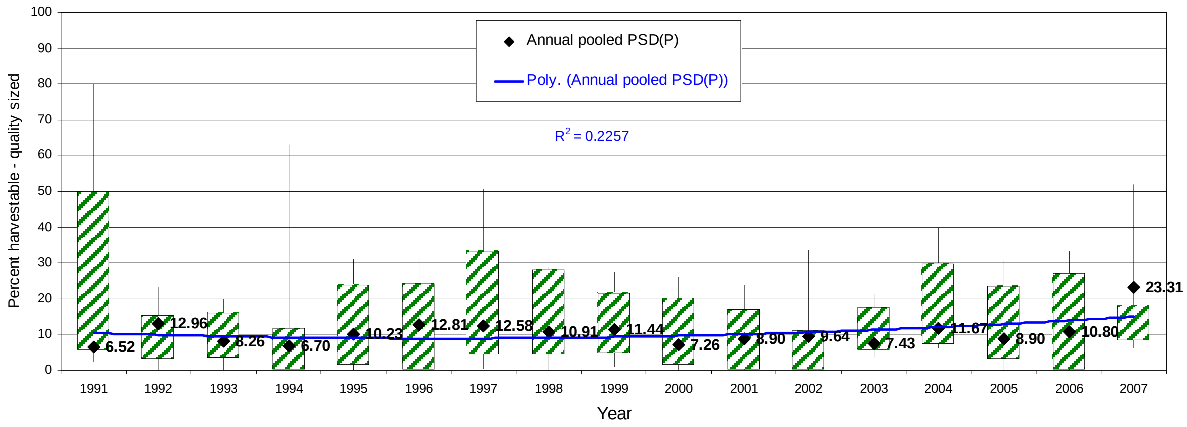

Figure 3.17—Largemouth bass annual pooled PSD-Preferred by year.

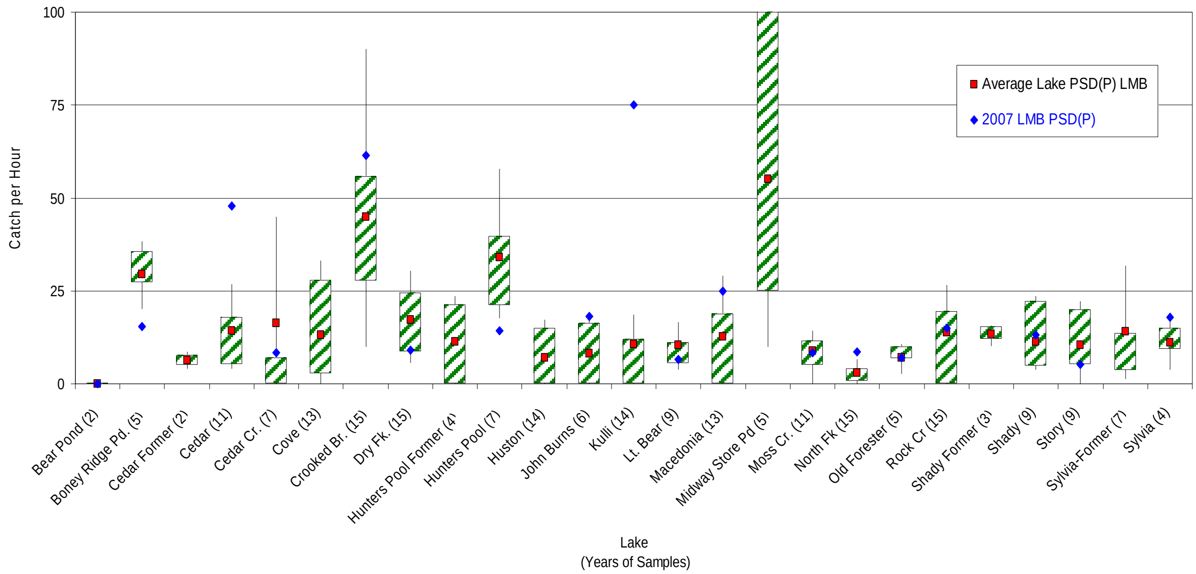

Figure 3.18—Largemouth bass annual pooled PSD-Preferred by lake.

Interpretation of Trends: As with bluegill population trends, the results for largemouth bass catch and harvestability are heavily influenced by timing and which lakes and ponds are sampled in any given year. Annual Forest-wide bass catch and catch per hour increased dramatically with the use of the new electrofishing boat at night in 1993 but then fell with the dropping of nighttime sampling. The trend in annual catch rates then slowly climbed with the addition of Macedonia, Story and Moss Creek Ponds to the sampling database. An incredible catch of 379.54 bass per hour occurred at Cedar Lake in 1996. However, this electrofishing was conducted strictly to capture tagged Florida strain largemouth bass and transfer as many as we could (101 individuals) to Crooked Branch. This became necessary when the entire shipment of bass for both Cedar and Crooked Branch Lakes was inadvertently placed into just Cedar Lake. Only one complete circuit of the lake was electrofished and only bass were collected, making for a more efficient than normal sample. These bass were just over stock size at 8-10 inches in length (200-254 mm) but were not yet harvestable; this sample also explains the slight dip in

PSD for 1996. In 1997 another even more incredible capture of 572.16 bass per hour occurred at Macedonia Pond and a catch of 148.17 bass per hour at Story Pond, both in the fall. A catch of 172.95 bass per hour at North Fork Lake was made in the spring of that year also. This latter sample occurred with the lake several feet above normal pool elevation and the heavily wooded cove could be sampled more effectively because of being able to float over stumps that normally impede boat movement through the coves. The 1998 catch per hour is down because the three aforementioned ponds were not sampled. In 1999, four abnormally high catches were made, 173.32 bass per hour at Cedar Lake, 123.08 at Moss Creek, 157.46 at North Fork Lake, and 461.39 at Story Pond. North Fork, Cove and Cedar Lakes show exceptional catches in 2001 which pushed the year's hourly catch to the third highest for the reporting period. The 2002 catch was the largest to date and incredibly 9 of the 20 lakes sampled had bass catches over 100 per hour. The 2002 Cedar Lake catch rate of 248 bass per hour was higher than any of the waters sampled in Oklahoma by the Oklahoma Department of Conservation. Largemouth bass catches, as with bluegill, can be very much a hit-or-miss proposition. The large boxes and whiskers show this variance in Figure 3.14 in catch rates for the individual lakes as well as between the lakes.

The trend seems to be an increase in bass catch per hour from 1991 to about 1996 and then some fluctuation around an average of 60-80 bass per hour since 1996. This is an acceptable and expected outcome considering sampling changes and new and or rehabilitated lakes and ponds being added to the sampling schedule. While this is below the informally set target of 100 bass per hour, given the size and flow-through rates of the sampled water, and the limitations on selecting perfect sampling conditions, the results are quite acceptable.

Bass PSD scores for 1992 and 1997 averaged somewhere between the 20's to 30's and were heavily influenced by young bass just entering the harvestable size classes, with strong year-classes resulting from initial spawns in these new and restored waters. Since 2004 the PSD scores have been in the 40's to 50's and showing less influence of younger year classes which is expected with most waters now in the ten plus age bracket. Figure 3.16 shows the variances between PSD valves for each waterbody and between each waterbody.

A certain degree of fluctuation in annual catch rates, PSD and PSD-Preferred results by year and by individual lakes by year is expected. When taking these factors into consideration plus waterbody productivities, all lakes and ponds appear to be producing bass at expected and/or acceptable levels with the possible exception of Cedar Creek Lake which is showing poor catch rates and the greatest variability in harvestabilities of bass of all of the lakes and ponds. Spring electrofishing at Cedar Creek Lake has been plagued by mechanical difficulties and missed peak temperatures for sampling which has contributed to the poor results. In addition, the more open and steeply-sided dam end of the lake is all that is sampled which might not be indicative of the fish population in the heavily timbered, standing snag areas of the upper lake. While Crooked Branch catch rates are fairly consistent, the range of PSD has shown more variance than normal, mostly due to the small sample sizes and the randomness of sizes of bass captured. The lake is difficult to sample due to extensive weed beds ringing the shoreline and abundant standing snags which makes maneuvering particularly difficult. In 2007, the catch rate and harvestability of bass at Crooked Branch was more in line with its long-term average but more of the shoreline was electrofished than in the past. Kulli shows a lot of variation in bass capture rates with some of the lowest values for PSD. The lake has been experiencing significant leakage off and on over the years. Work was done to patch one leak some years back that was successful but now another leak apparently has developed and the lake has been too low to sample the last three years. This fluctuation in water level leads to fluctuations in fish population quantity and quality. Until the lake level stabilizes, catch rates and harvestabilities will not likely stabilize either. Macedonia Pond also shows quite a bit of variability in PSD which is attributed to five very large bass samples dominated by smaller bass from several strong year classes. This pond has also been sampled too early in the fall in the past several years when water temperatures were too warm for bass to be actively foraging during the daylight hours and thus more susceptible to electrofishing capture. Macedonia's 2006 and 2007 PSD scores were quite high which was compounded by a low bass catch rates each year.

Consequences for Conservation of the Species: Largemouth bass are among the most widespread and numerous species within the Forest's waters. The species' viability is not in question. This species is regularly stocked in all new and reclaimed ponds and lakes as an essential component of the sport fisheries. When bass reproduction appears questionable based on shoreline seining results, fingerling bass stocking is requested from the appropriate state game and fish agency and takes place depending upon fingerling availability through the state's fish hatchery system.

Implications for Management: Largemouth bass fishing opportunities abound across the Forest. As with bluegill, these opportunities are not equal at all waters. Water body age, rates of inflow and outflow, and whether the waters are being limed and fertilized all have a bearing on bass production. Also to be factored in is the size and health of the populations of prey species including but not limited to bluegill. Considering these variables, all populations within the Forest are within expected ranges, other than Cedar Creek Lake, which seems to have gotten off to a slower start than seen before. The intensively managed Macedonia and Story Ponds are by far the best pond bass fisheries on the Forest and have some exceptional bass. However, they are being affected by the on-going drought. With the depth and surface area of each pond reduced; the fish population are being negatively affected. The restored fishery in Cedar Lake is providing some exceptionally good bass with the biggest electrofished bass captured in Oklahoma coming from there in 2004 and 2005 (10.3 and 11.3 pounds respectively). The bass fishery at Cedar Lake has also been the beneficiary of repeated stocking of pure strain Florida bass. Upwards of 66 percent of the bass in the lake are either pure strain Florida's or first generation crosses with northern largemouth bass. Other waters, such as Dry Fork, will produce sizeable bass but because of low productivity brought on by lake age and high flow through rates, they will never reach the density of bass of the pond fisheries.

Ease of boat access appears to play a role in the size and shape of the bass populations in the flood control lakes within the South Fork Fourche LaFave watershed. Those with the most difficult access for launching a boat (Little Bear and Huston through 1998) produce the better bass sample catch per hour rates whereas those with good concrete ramps (Dry Fork and Rock Creek) generally have lower sample catch rates. Considerations to improve boat access to water bodies needs to include an assessment of the potential impacts to the recreational fisheries. That is not to say that improving access is bad, but that the fishery will adjust to fishing pressure changes. Generally any increase in fishing pressure will result in an increase in the total quantity of harvest. As fishing pressure increases, angler catch rates will decline at some point, driving down the quality of the harvest as well as that of the individual fish caught. Changes in the intensity of fisheries management through regulation changes, habitat improvement, stocking rate changes, etc. are utilized in an effort to offset or head off unacceptable declines in the recreational fisheries. Through our sampling we hope to detect undesirable trends in the fisheries and make course corrections in a timely fashion.

Forest-wide, because of the age of the water bodies being sampled, particularly the aging of the ponds, some decline in bass numbers caught per hour and harvestability should be expected in the long-term. The decline in numbers caught per hour already seems to be happening but harvestability is still increasing, the latter being the case of new or restored fisheries peaking out. Current budget levels are not sufficient to maintain productivity through habitat enhancements.

Chapter IV: Terrestrial Vertebrates

White-tailed deer (*Odocoileus virginianus*)

The white-tailed deer (*Odocoileus virginianus*) is a management indicator species (MIS) that was selected to help indicate the effects of management on meeting the public hunting demand (USDA Forest Service 2005, Final EIS Page 165).

Data sources: Data sources and monitoring techniques for this species include deer spotlight survey counts (Urbston 1987), harvest and population trend data from the Arkansas Game and Fish Commission and Oklahoma Department of Wildlife Conservation, CompPATS deer habitat capability model, and acreage of early successional habitat created by year.

In the Revised Land and Resource Management Plan (USDA Forest Service. 2005) the desired habitat condition is to sustain healthy populations of native and desired non-native wildlife and fish species.

Population Trends: Based on annual spotlight survey data collected between 1990 to present, average deer density has varied from a low of 29 deer per square mile in 2001, to 65 deer per square mile in 2007. Figure 4.1 displays deer per square mile by year. The average density for the Forest for all years is 46 deer per square mile. These data indicate that deer density on the Forest has an increasing trend.

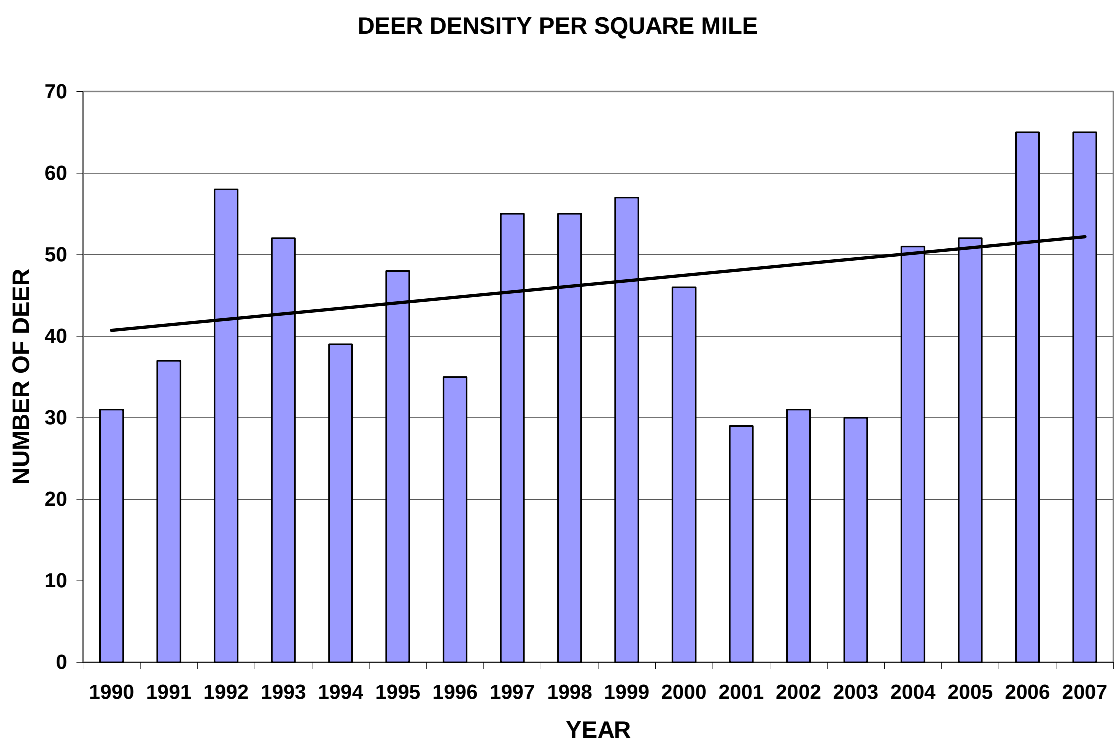

Figure 4.1—Ouachita National Forest deer per square mile 1990 – 2007 based on deer spotlight data.

Deer harvest data also indicate an increasing harvest in the counties encompassed by the Forest with the highest harvest year in 2006. Deer harvest has increased from a low of 4,995 in 1994 to over 20,000 in 2006. Deer harvest can be a relative indicator of deer abundance however the influence generated from changes in hunting regulations and harvest limits cannot be determined.

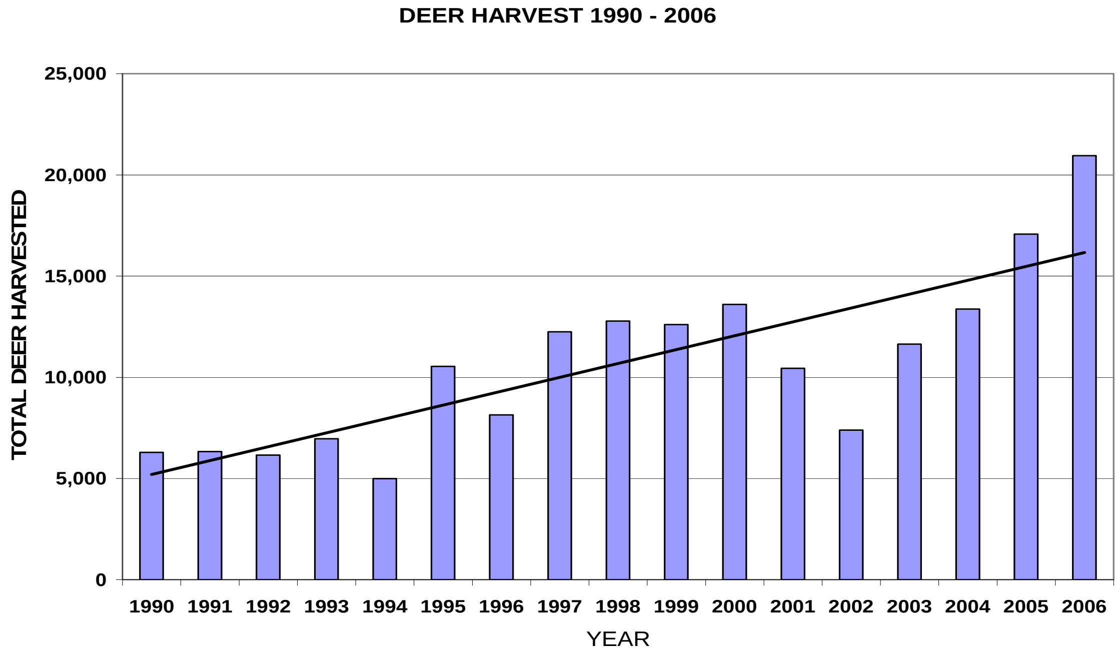

Figure 4.2—Ouachita National Forest deer harvest by year from 1990 - 2006

Modeling habitat capability using the CompPATS model and vegetative data from the Field Sampled Vegetation (FSVeg) is a way of evaluating the ability of the existing habitat to support deer. The estimated habitat capability for deer or the years 1994-2007 is shown in Figure 4.3. Habitat carrying capacity is influenced by the amount of prescribed burning and early seral habitat created. The long term habitat capability is showing a downward trend.

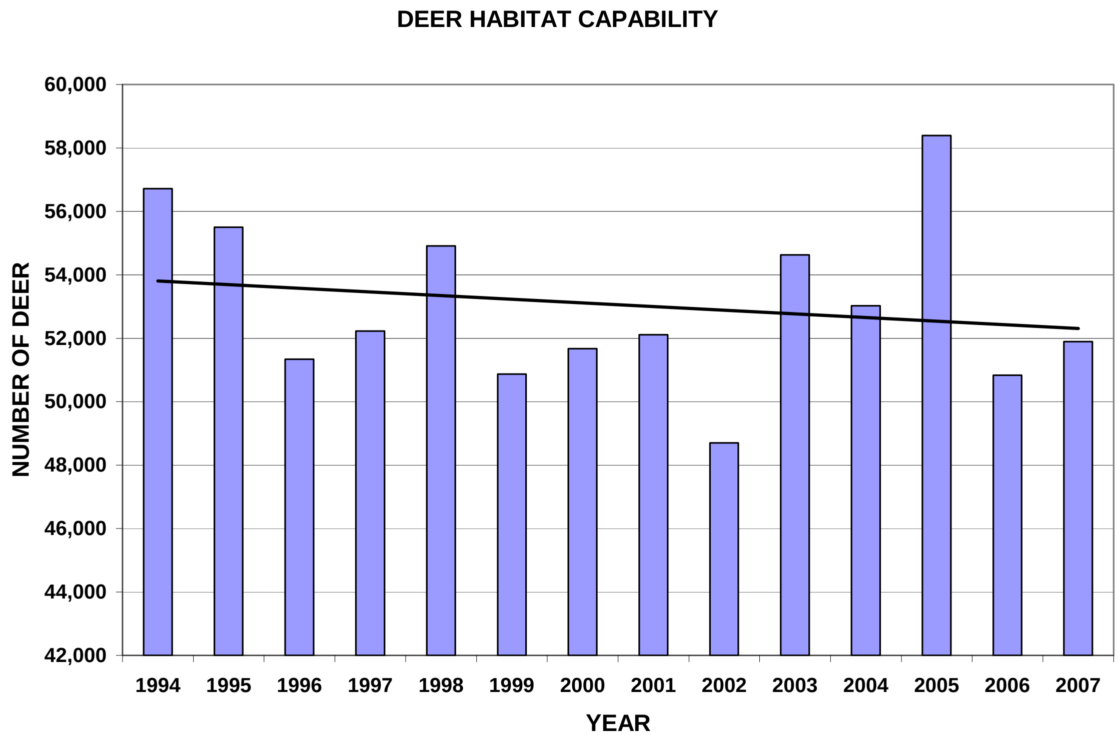

Figure 4.3—Ouachita National Forest deer habitat capability by year 1994 - 2007.

The Final EIS for the Revised Land and Resource Management Plan (RLRMP) (September 2005) indicates in Table 3.59 page 166, a desired terrestrial habitat capability to support and average of 13.7 deer per square mile after 10 years. This is calculated on a land base of 1,780,101 acres for a habitat capability that would support 38,105 deer. The habitat capability as estimated by CompPATS exceeds the Revised Plan projections for every year in the period 1994-2007, but is showing a slight decline though not a significant trend. The deer spotlight survey and deer harvest data indicate an increasing deer density. The creation of early seral habitat as shown in Figure 4.4 shows a slight increasing trend overall. The RLRMP objective is to create 5,500 acres of grass/forb habitat per year, and 2,915 and 4,066 acres were created in 2006 and 2007, respectively.

Interpretation Of Trends: The slight decline in the habitat capability for deer as estimated by CompPATS is probably related to the decrease in the acres in grass/ford habitat (forest types ages 0-10 years) preferred by deer. The acres of created early successional habitat have not met the desired levels but did show an increase in 2007.

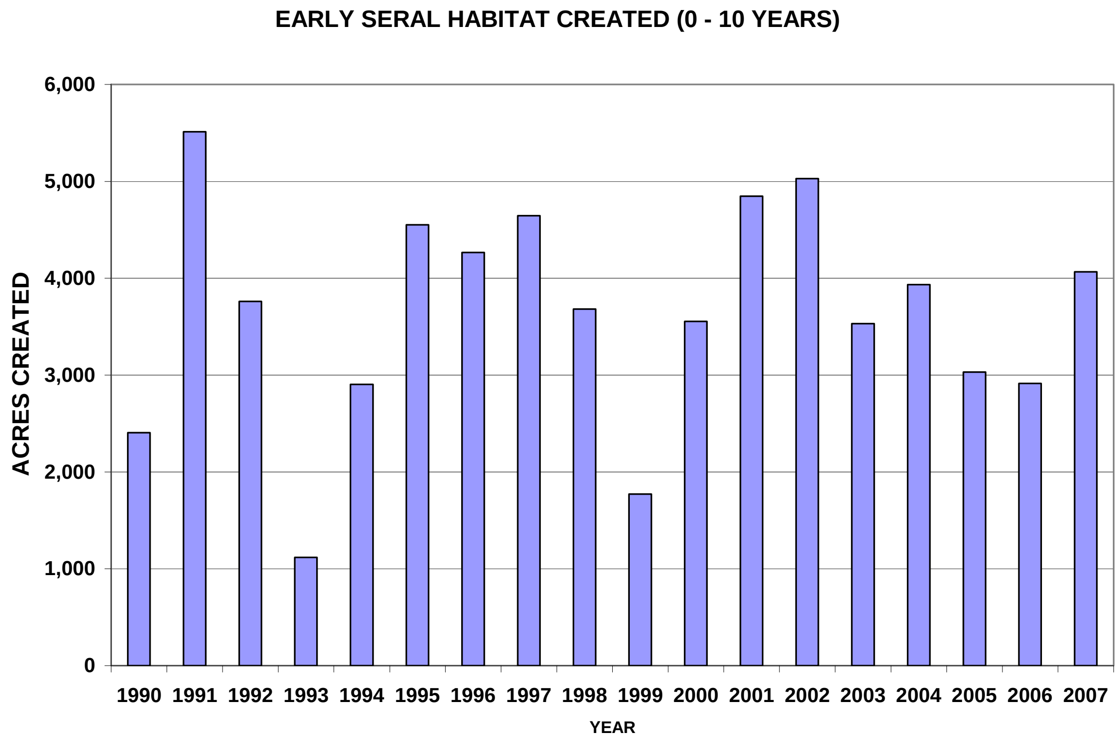

Figure 4.4—Acres of early successional habitat created by year 1990 - 2007.

For deer, the CompPATS model places a greater value of early successional habitat and gives lesser value to habitat created by thinning and prescribed burning. In contrast to the declines in even age regeneration cutting, the acres of thinning and prescribed burning have increased. In view of the deer population and harvest indicators, deer are not yet declining with the habitat capability.

Implications for Management: Deer are widespread, abundant and the habitat capability still remains above the Plan projection. There are no indications of a need for adjustments in current management practices.

Northern bobwhite (*Colinus virginianus*)

The Northern bobwhite (*Colinus virginianus*) is a Management Indicator Species. It was selected to help indicate the effects of management on meeting public hunting demand, and to help indicate effects of management on the pine-oak woodland community (Final EIS, Revised Land and Resource Management Plan, page 165, Sept. 2005).

Data Sources: Data sources and monitoring techniques for this species include bobwhite call counts; data collected on Breeding Bird Survey (BBS) routes, 1966 to 2006 (Sauer et al. 2007); the CompPATS Habitat Capability Model; and the Ouachita National Forest Landbird monitoring data collected from 1997 – 2007. Data collected using call counts are presented as birds heard per stop. In the Revised Plan, the population objective for the bobwhite is an average of 36.6 birds per square mile (FEIS page 166, September 2005).

Population Trends: In the period between 1990 and 2007, birds heard per stop have varied from a high of 1.2 birds per stop in 1992 to a low of .5 birds per stop in 1999, 2000 and 2001 (Figure 4.5). Over this 17 year period the Ouachita region averaged .5 birds per stop per year. This average exceeds the average for all other regions in Arkansas. In contrast, the decade prior to 1990 when the Forest had more and was actively creating more early successional habitat, the Ouachita averaged 1.3 birds heard per stop. Data are indicating a slight increasing trend for the current evaluation period, but calls per stop are lower than they were prior to 1990.

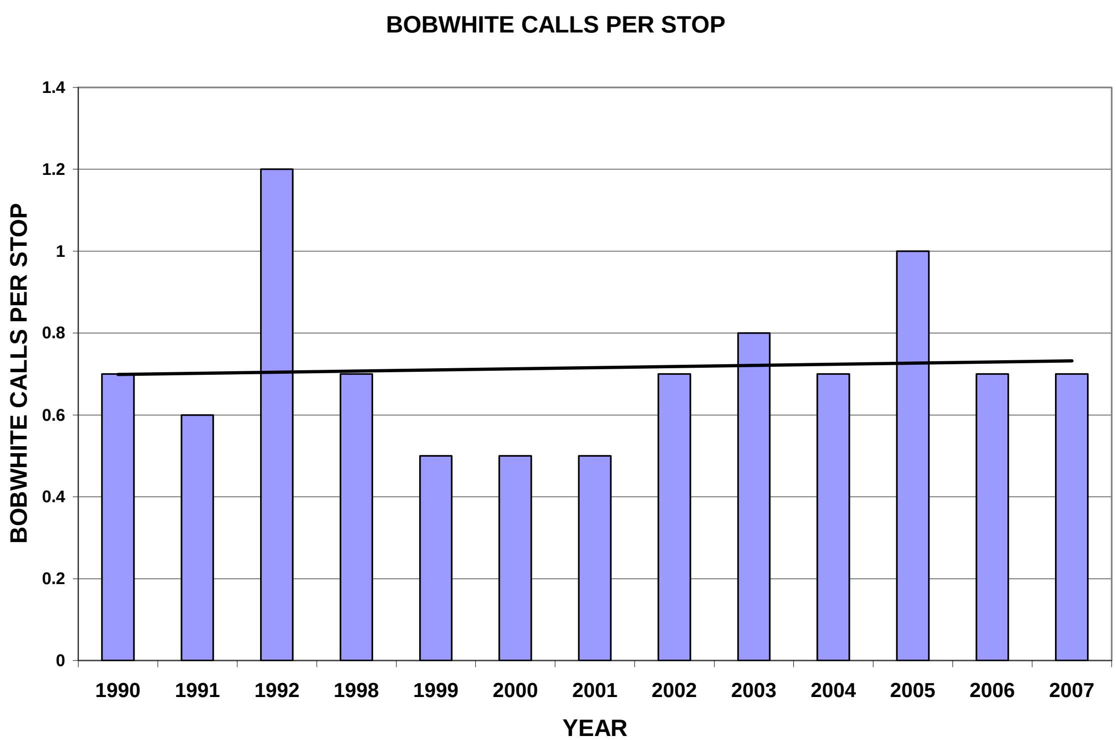

Figure 4.5—Ouachita Northern bobwhite calls per stop for data years 1990 - 2007.

Since 1997, the Forest has been conducting bird surveys on over 300 Landbird monitoring points. Bobwhite data recorded through these surveys indicate an increasing trend in birds detected over this 10 year period (Figure 4.6).

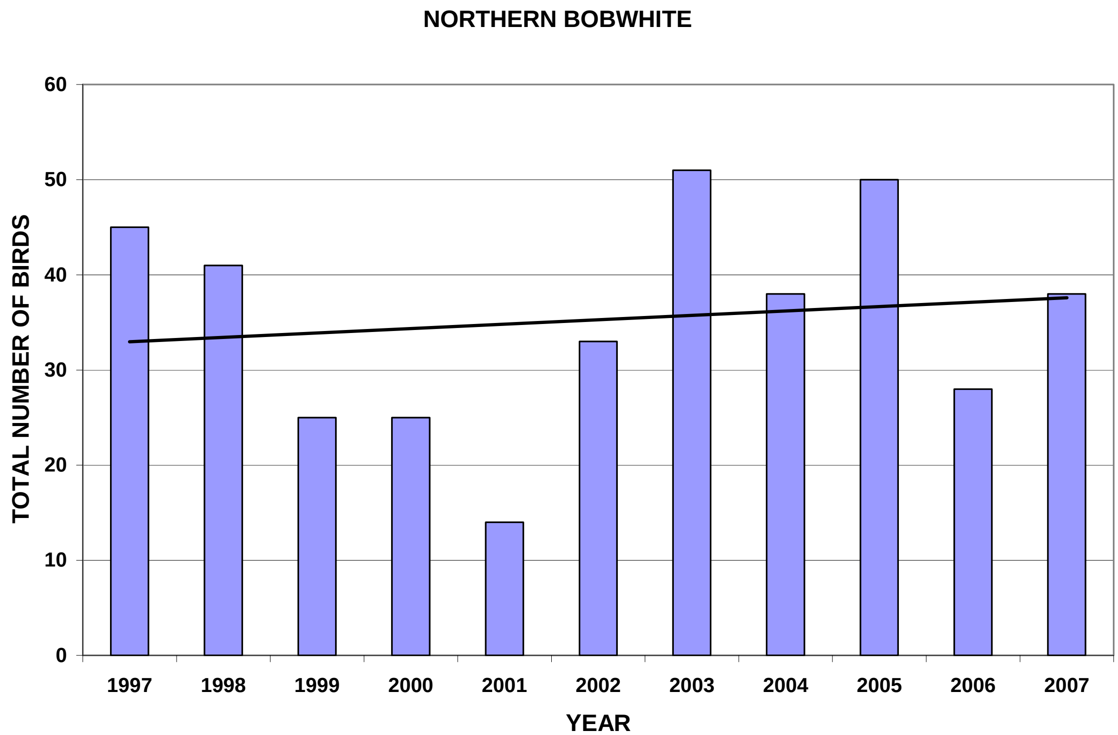

Figure 4.6—Northern bobwhites detected on Landbird survey points, Ouachita National Forest, 1997 – 2007.

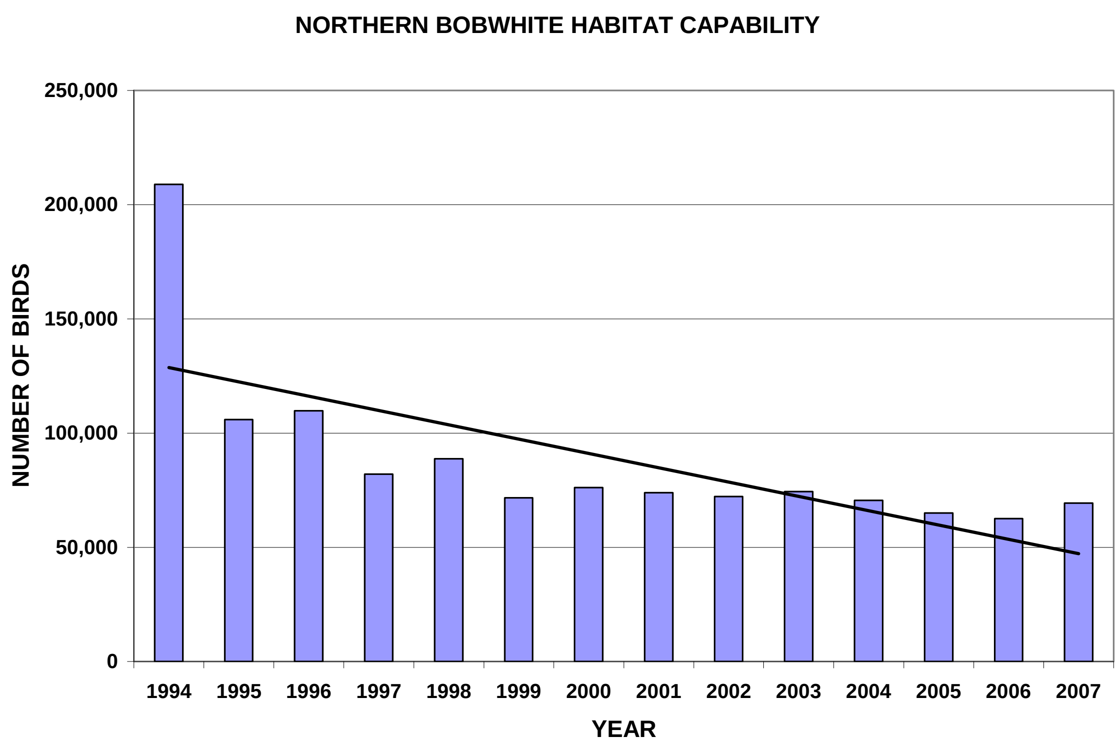

Figure 4.7—Northern bobwhite habitat capability 1994 – 2007, for the Ouachita National Forest.

The CompPATS, habitat capability estimate for the bobwhite, has declined steadily (Figure 4.7) and although the creation of early successional habitat is showing a slight upward trend (Figure 4.8) this habitat creation has not yet reached the Plan objective of 5,500 acres per year.

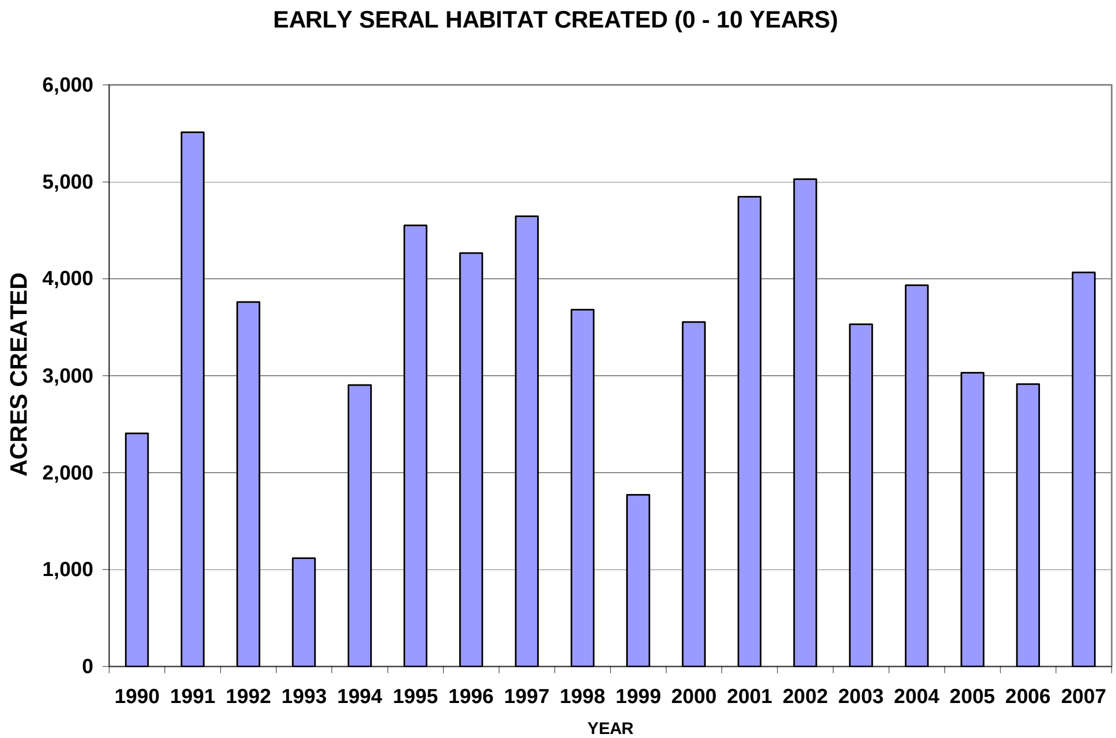

Figure 4.8—Early seral habitat created 1990 – 2007.

Breeding Bird Survey data (Figure 4.9), collected over the past 40 years (1966 through 2006), indicate a 3.5 % decline for the Ozark - Ouachita Plateau, a 3.0% decline for Arkansas, and a 3.0 % decline range-wide (Sauer et al. 2007). Data for the more recent time period of 1980 – 2006 show a greater bobwhite decline of 4.5 % for the Ozark – Ouachita Plateau.

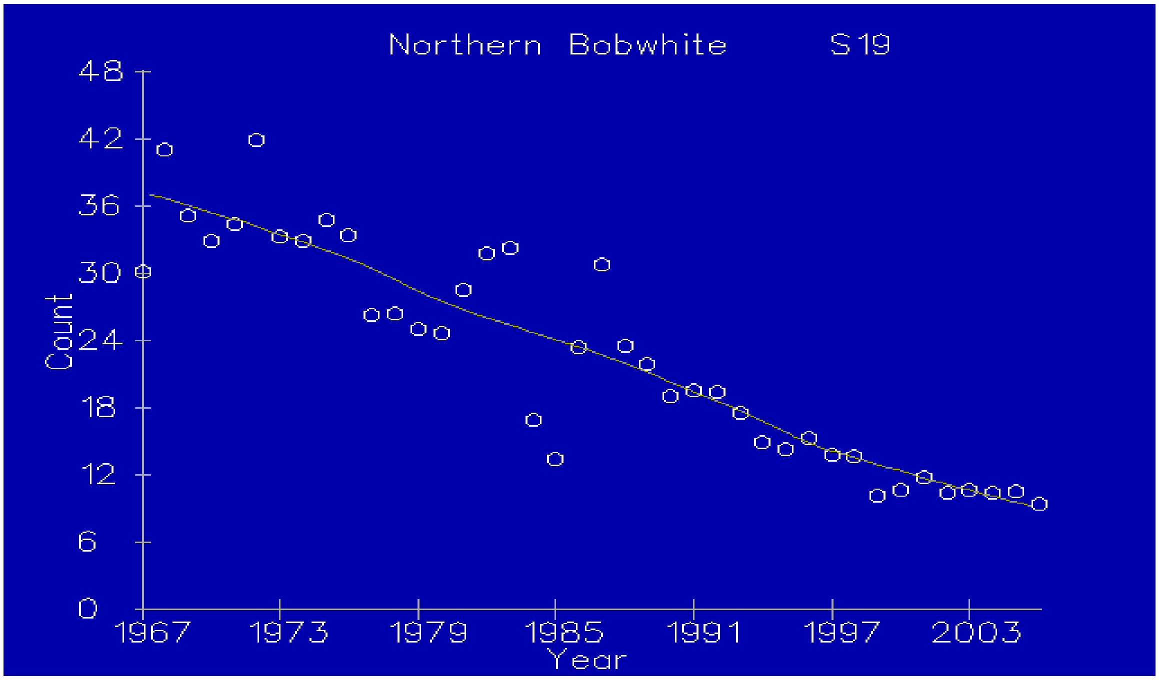

Figure 4.9—Northern Bobwhite Breeding Bird Survey trend data 1966 – 2006 for the Ozark – Ouachita Plateau.

Interpretation of Trends: Bobwhite call counts per stop, Landbird point data, and trend in early successional habitat creation all indicate a slight increase in bobwhites, whereas, the habitat capability and the Breeding Bird Survey, are indicating declining habitat capability for the Forest and a declining population trend for the Ozark – Ouachita Plateau region. Regional and range-wide declines are primarily attributed to the loss of habitat on private and agricultural lands and changes in agricultural practices. The weak increasing trend for the Forest could be due to the aggressive prescribed burning and thinning programs which are providing habitat improvements.

Implications for Management: The population viability for the Northern bobwhite is not expected to be threatened. This trend is expected to improve through implementing the Revised Forest Plan. The decline in habitat capability is partially due to a failure to produce the amount of early seral habitat (5,500 acres) each year envisioned by the Forest Plan. There will be a lag time between guidance established in the Revised Plan and the creation of additional early seral habitat. In the meantime, increases in thinning and prescribed burning, especially that associated with some 200,000 acres of shortleaf pine-bluestem grass ecosystem restoration, will benefit bobwhite populations by improving habitat.

Eastern wild turkey (*Meleagris gallopavo*)

The eastern wild turkey (*Meleagris gallopavo*) is a Management Indicator Species (MIS) selected to indicate the effects of management on meeting public hunting demand (USDA Forest Service. 2005 Final EIS. Page 165).

Data Sources: Sources of data include turkey poult surveys, spring turkey harvest data, Breeding Bird Survey data (Sauer et al. 2007, habitat capability modeling using CompPATS and Landbird point survey data. In the Revised Land and Resource Management Plan (RLRMP), the minimum population objective is 3.3 turkeys per square mile (9,177 turkeys) after 10 years and 3.9 per square mile at 50 years (USDA Forest Service. 2005 Final EIS. Page 166). Habitat capability for 2007 is estimated at 18,316 turkeys.

Population Trends: Over the past decade, the number of turkey poults per hen has varied from a low of 1.45 poults per hen in 1993 to a high of 3.7 poults per hen in 1997(Figure 4.10). In 2007 there were 1.9 poults per hen which is slightly greater than the previous two years but less than that of the past decade. The 2007 habitat capability can support over 18,000 turkeys which is an improvement over 2006. However factors other than habitat are apparently involved. The Arkansas Game and Fish Commission is considering turkey in a downward trend and have modified seasons to improve the situation. There is a recognized turkey downward trend in turkey populations at this time.

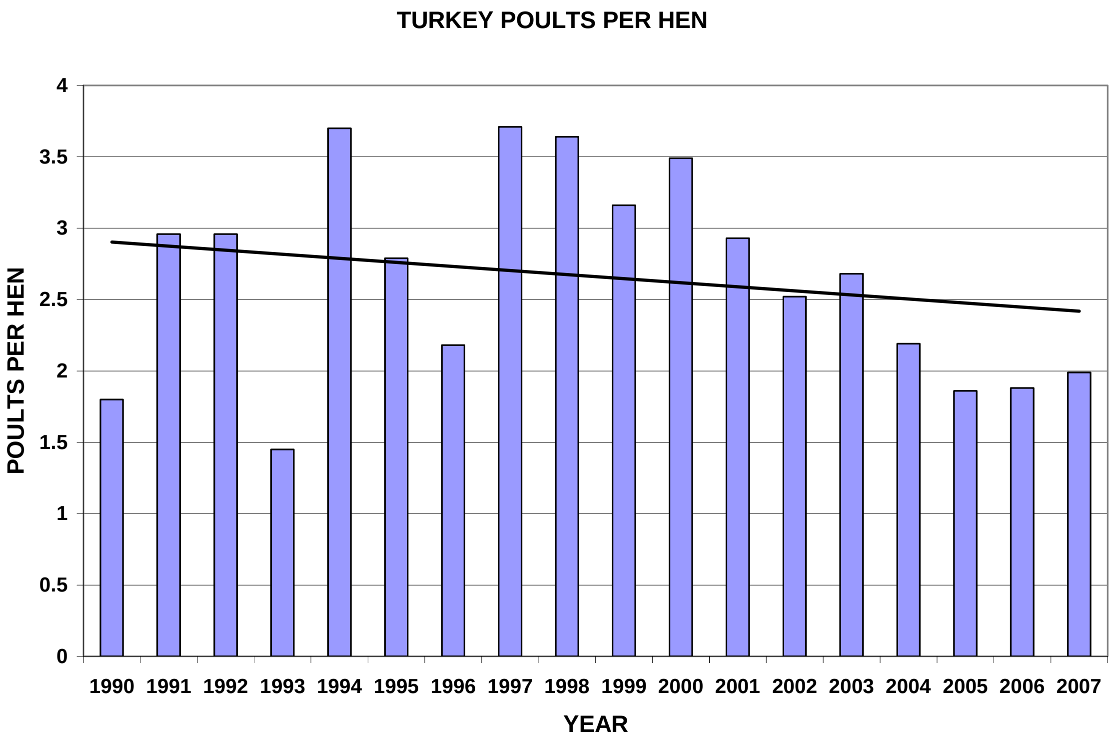

Figure 4.10—Eastern wild turkey poults per hen on the Ouachita National Forest, 1990 – 2007.

Spring turkey harvest has increased from low of 1,631 birds in 1993 to high of about 4,017 birds in 2003 and declined to 2,163 in 2007 (Figure 4.11).

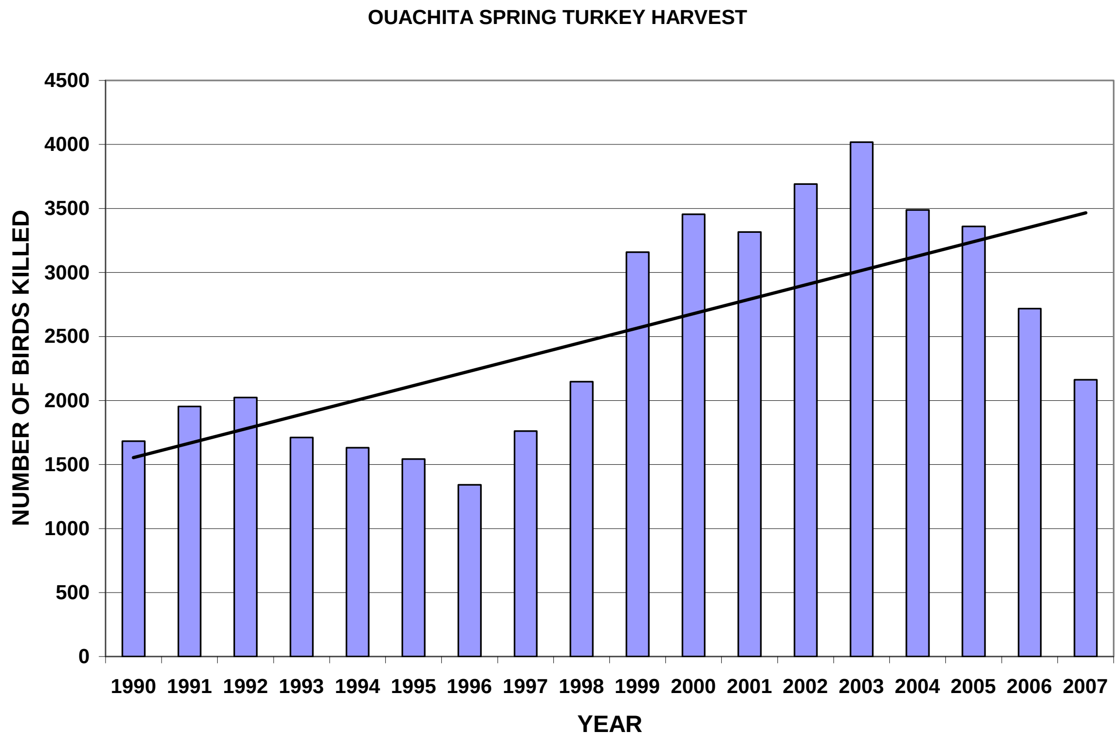

Figure 4.11—Eastern wild turkey spring harvest 1990 – 2007, Ouachita National Forest

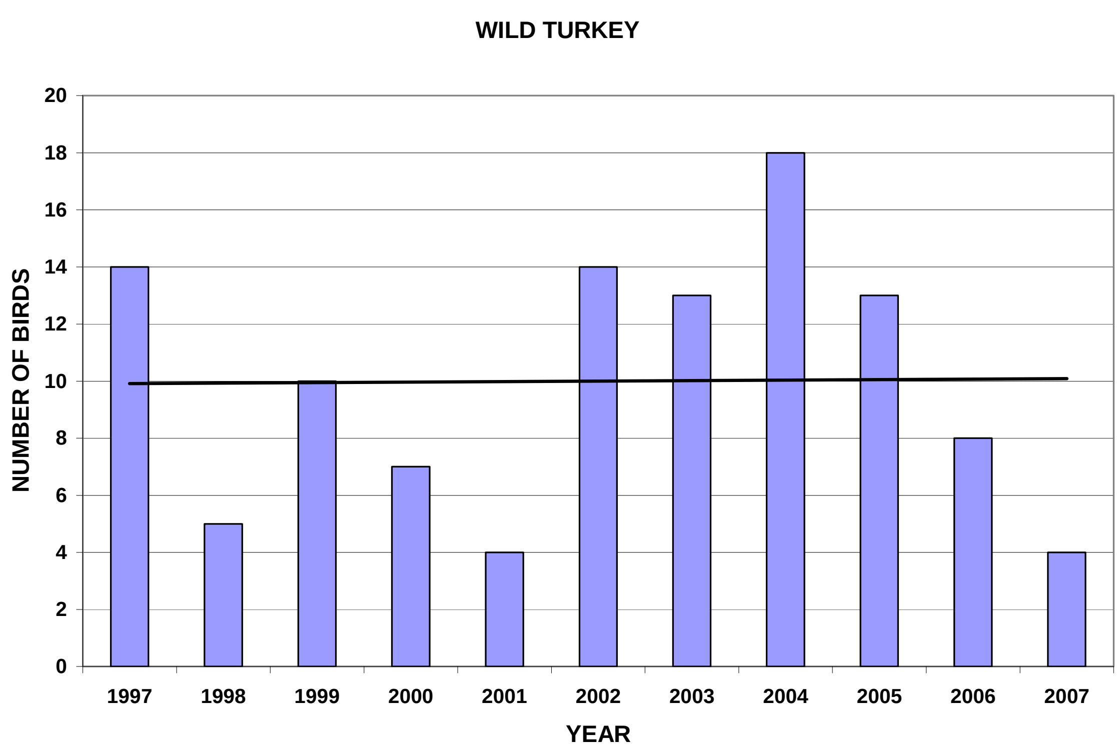

Figure 4.12—Eastern wild turkey detected on Landbird points, Ouachita National Forest, 1997 – 2007.

The wild turkey trend detected on the Forest Landbird point surveys is similar to the drop in harvested birds but statistically showing a stable trend over the past decade.

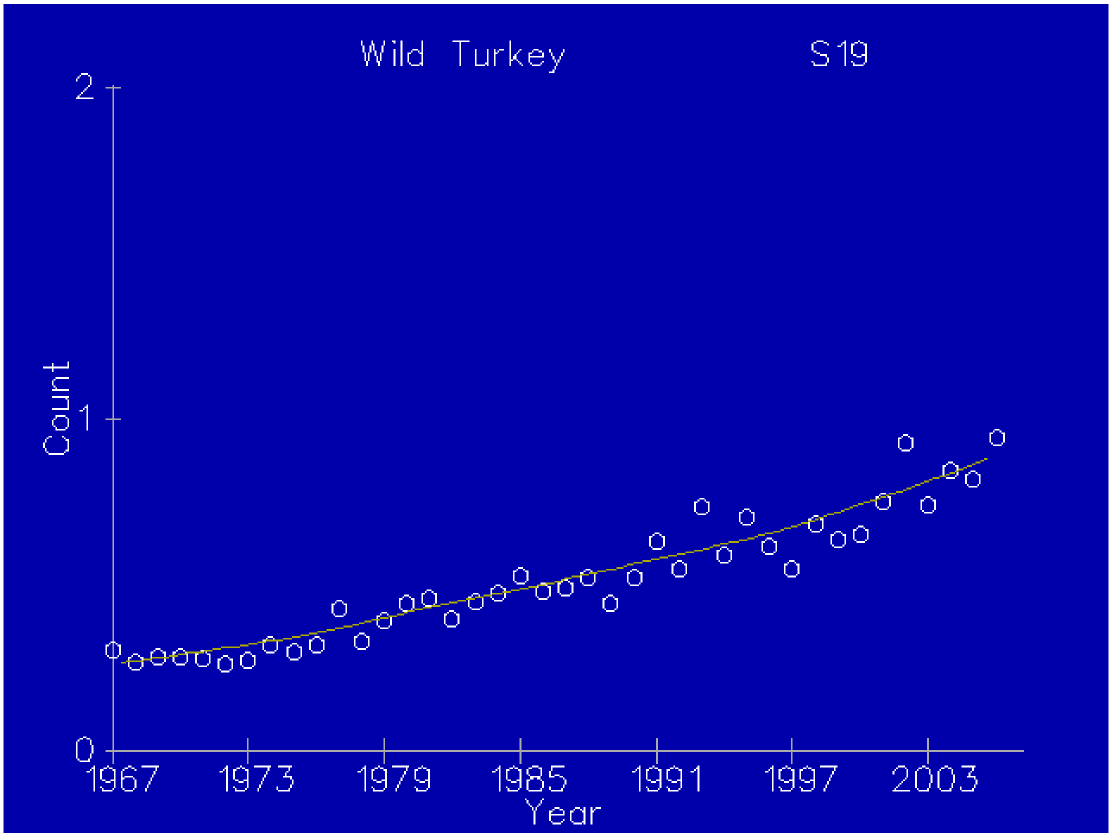

Figure 4.13—Eastern wild turkey Breeding Bird Survey data for the Ozark – Ouachita Plateau 1966 – 2006.

The Breeding Bird Survey data for the Ouachita Mountains indicate a 2.3 % increase in the turkey population from 1966 to 2006, but a 0.3 % decline for 1980 – 2006 (Sauer et al. 2007).

Figure 4.14 below depicts changes in habitat capability for the years 1994 - 2007. The overall trend is improving with a habitat capable of supporting 18,316 birds. This is above the RLRMP objective 9,177 birds for the first period (USDA Forest Service. 2005 Final EIS. Page 166).

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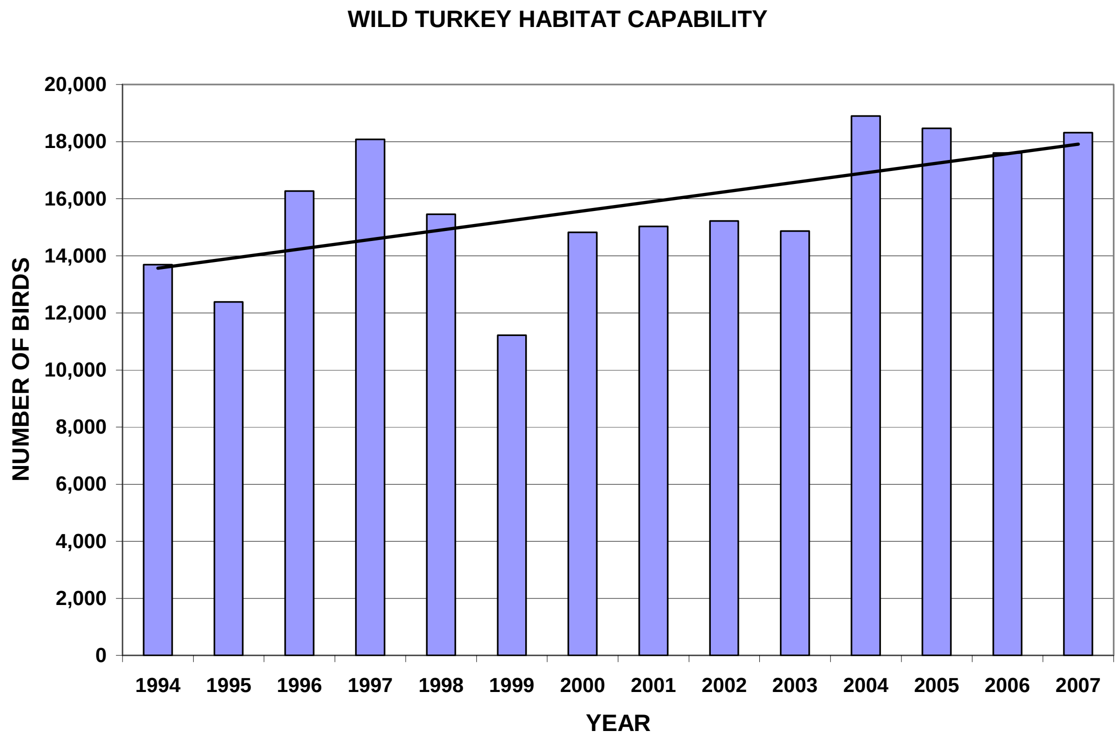

Figure 4.14—Eastern wild turkey habitat capability for the Ouachita National Forest 1994 - 2007.

Interpretation of Trends: Long term **t**urkey harvest, habitat capability and Breeding Bird Survey data indicate overall positive trends for the turkey population. However the drop in harvest levels, poults per hen, and birds detected on the Landbird points, mirror a reduction in 2005 - 2007. This does not negate the long term positive trend, but does identify potential problems that need watching. The habitat capability remains above the level set in the RLRMP and this sustained high level would indicate that the problem with turkey could be factors other than habitat related.

Implications for Management: Although there are some variations in poult production, harvest, and birds detected on Landbird point counts, the habitat capability and breeding bird surveys are showing positive trends. There is no reason to believe that this species is in danger of losing population viability or falling below the desired population levels. The Arkansas Game and Fish Commission has shortened the season to stimulate a positive response. Indications are that the eastern wild turkey and its habitat are doing well on the Forest but trends warrant watching.

Red-cockaded woodpecker (*Picoides borealis*)

The Red-cockaded woodpecker (*Picoides borealis*) is a Management Indicator Species (MIS) because it has Federal endangered species status. It was selected to indicate the effects of management on recovery of this species, and to help indicate effects of management on shortleaf pine-bluestem woodland community (USDA Forest Service. 2005 Final EIS. Page 166). The Revised Land and Resource Management Plan has a management objective to "maintain or improve the population status of all species that are federally listed or proposed for listing".

Data Sources: This is one of the most intensively monitored species on the Forest and monitoring is done with high precision, intensity and reliability. Active territories, nesting attempts, fledgling estimates, banding, augmentation, and the number of adults are tracked and reported annually to the Fish and Wildlife Service.

Population Trends: Over the past decade, the number of active territories and number of adult birds are both showing an increasing trend (Figure 4.15 and 4.16).

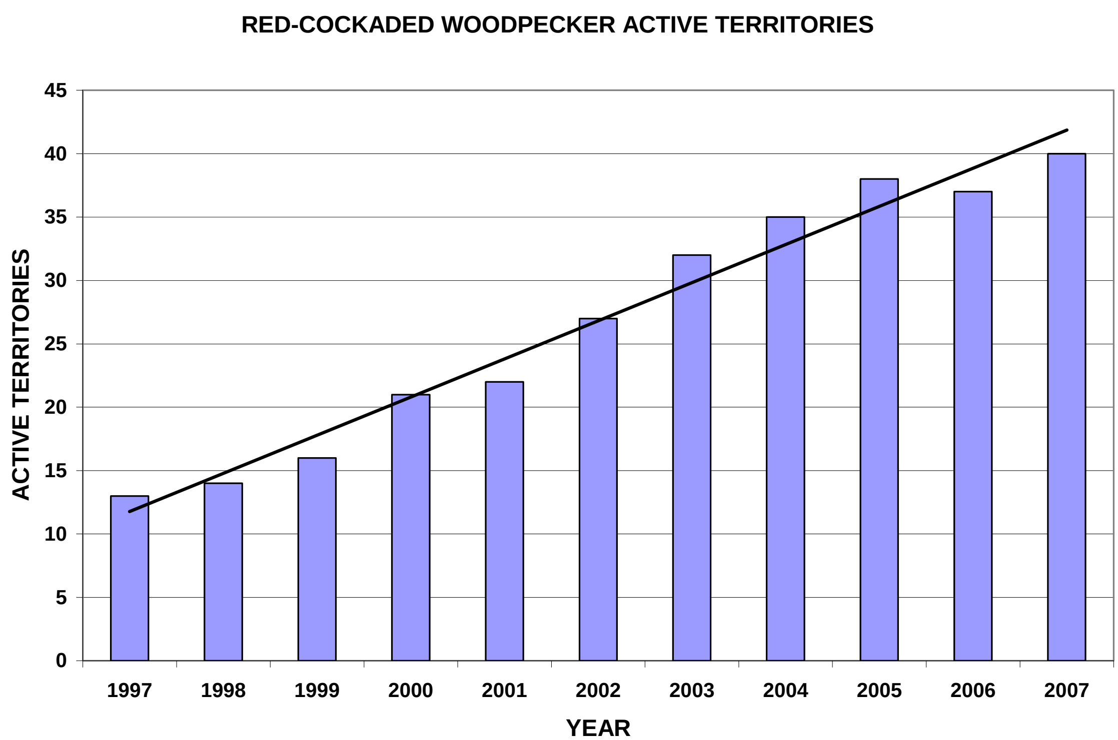

Figure 4.15—Red-cockaded woodpecker active territories, Ouachita National Forest 1997 – 2007.

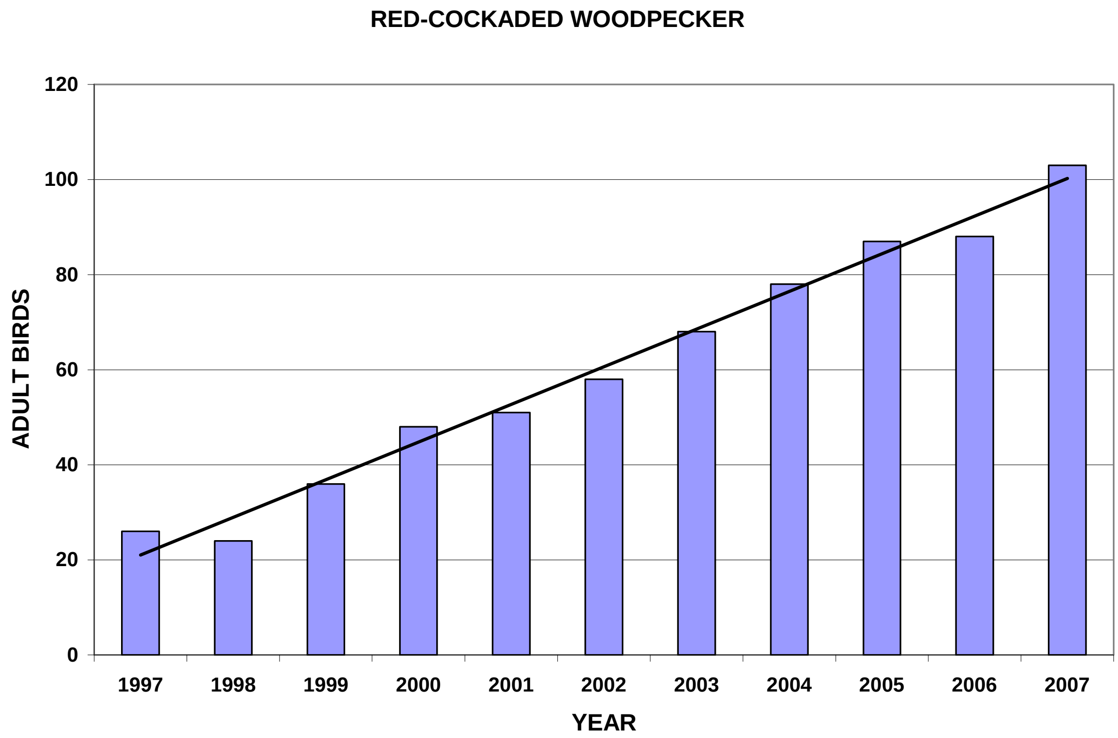

Figure 4.16—Red-cockaded woodpecker adult birds, Ouachita National Forest 1997 – 2007.

Interpretation of Trends: Populations of the red-cockaded woodpecker on the Ouachita have normal fluctuations. These changes appear more dramatic in smaller populations than they would appear in larger populations. To be able to maintain the status quo with slight increases in the number of active nest territories and adult birds is a significant step forward and indicates the management success and commitment for the recovery of this species.

Implications for Management: The population of this species exhibits an increasing trend. Barring any major catastrophic events this species should continue to improve under the present management intensity. A large-scale ecosystem restoration project was initiated in Management Area 22 to restore the shortleaf pine-bluestem grass ecosystem on over 200,000 acres. This process will provide sufficient habitat for a recovery population of the endangered red-cockaded woodpecker (USDA Forest Service 2005). As the pine/bluestem ecosystem is restored and the acres of quality habitat are increased, the main factors influencing species population and recovery will be the limitations of population dynamics and uncontrollable natural influences. The Forest management intensity will be maintained and intensive monitoring will continued.

Pileated woodpecker (*Dryocopus pileatus*)

The pileated woodpecker (*Dryocopus pileatus*) is a Management Indicator Species (MIS) selected to indicate the effects of management on snags and snag-dependent species (USDA Forest Service. 2005 Final EIS. Page 166). This species prefers dense, mature to overmature hardwood and hardwood-pine forest types. It is a primary excavator of cavities important to obligate secondary cavity nesters, and is a key indicator for the retention of a complete community of cavity nesting species.

Data Sources: The Forest Landbird point count data, North American Breeding Bird Survey (BBS) (Sauer et al. 2007), and habitat capability predictions using CompPATS and Field Sampled Vegetation (FSVeg) data were used as data sources for evaluating pileated woodpecker population trends.

Population Trends: Population trend as indicated by the Breeding Bird Survey data, Forest Landbird data and habitat capability data are mixed. Ten years of Landbird monitoring data on the Forest shows an overall increasing trend.

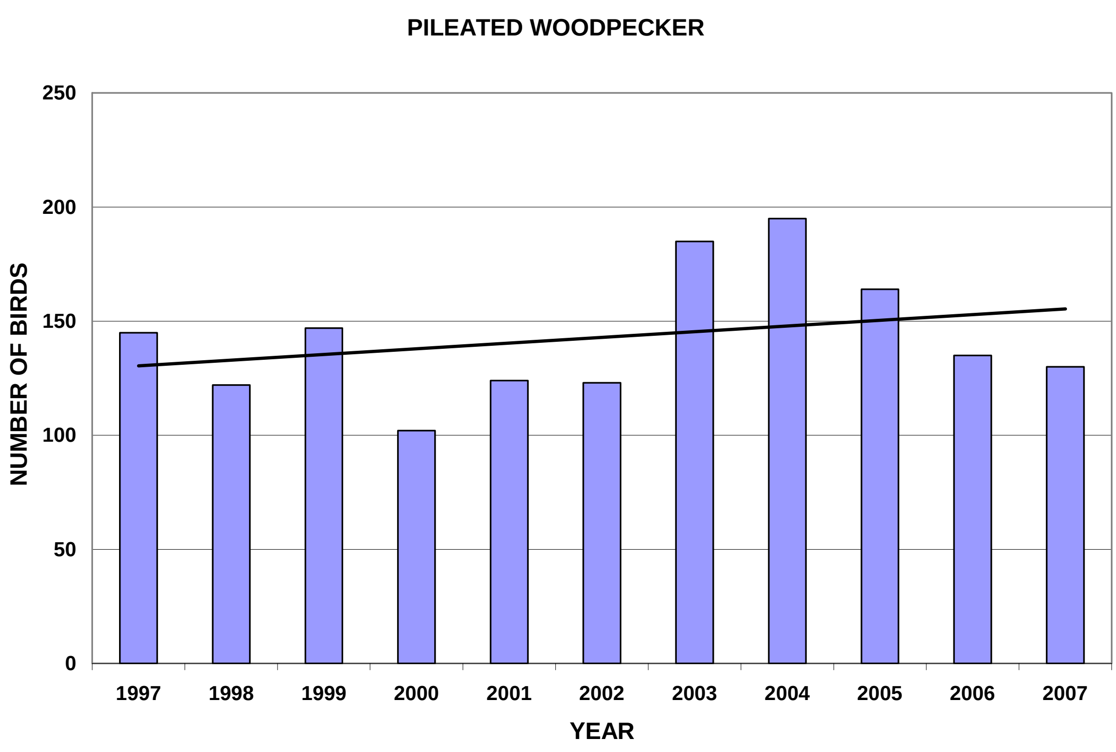

Figure 4.17—Pileated woodpeckers detected on Landbird point counts, Ouachita National Forest, 1997 – 2007.

The BBS data shown below in Figure 4.18, indicate a slight downward trend of -0.6 percent in the period of 1966 – 2006, but a positive trend of 1.25 percent increase for data from the 1980 to 2006 period, for the Ozark - Ouachita Plateau. Data indicate a positive 1.7 percent increase survey-wide.

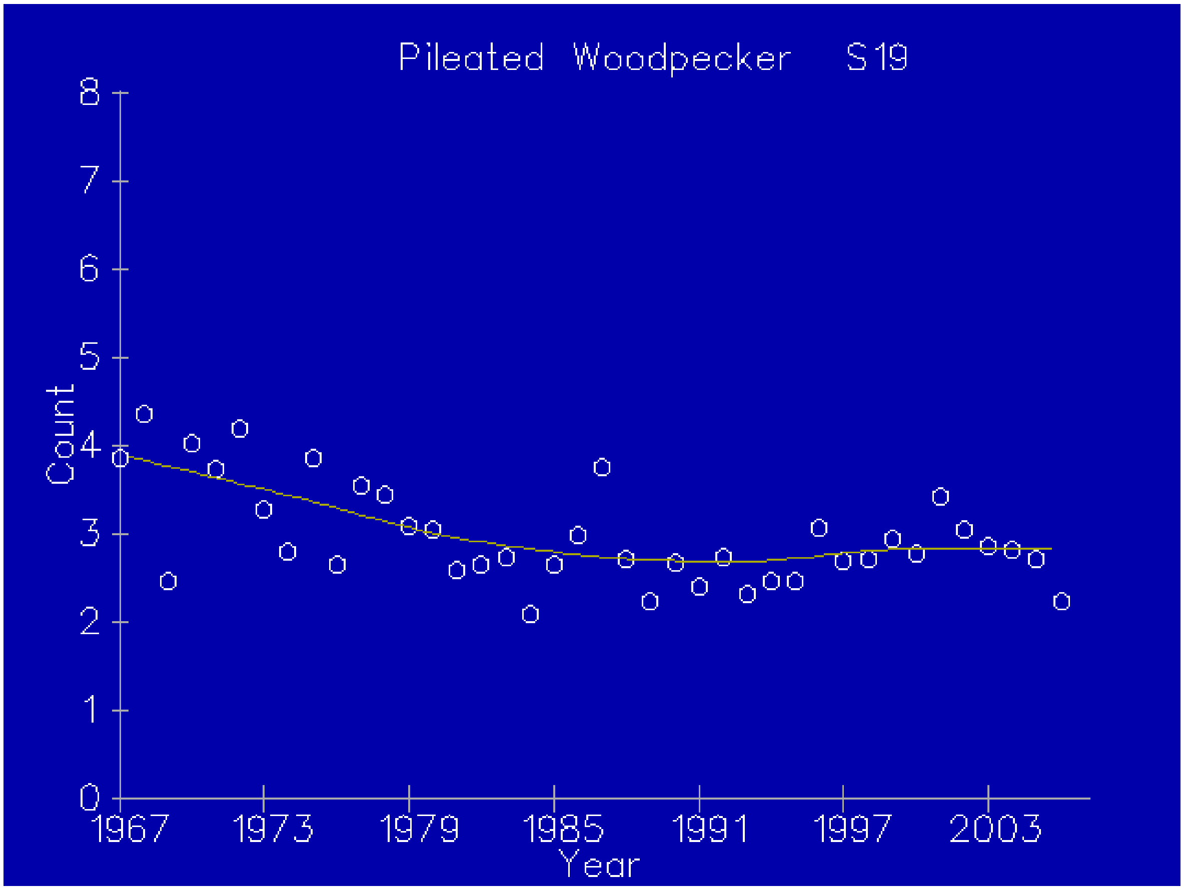

Figure 4.18—Pileated Woodpecker Breeding Bird Survey trend data 1966 – 2006 for the Ozark – Ouachita Plateau.

CompPATS estimating the habitat capability using all forest types indicate an increasing trend (Figure 4.19). These data are for pine, pine-hardwood, hardwood, and hardwood-pine stands with the greatest value being for stands greater than or equal to 41 years old. As these stands age, the habitat capability to support the pileated woodpecker should continue to improve.

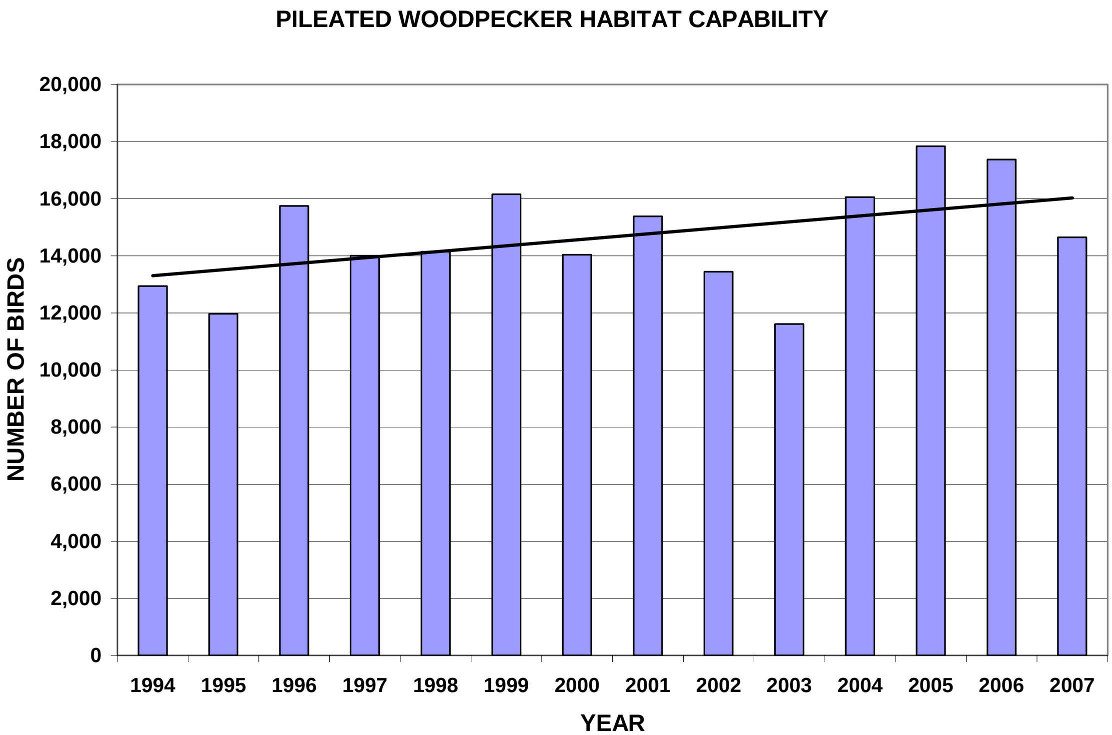

Figure 4.19—Pileated woodpecker habitat capability on the Ouachita National Forest for 1994 - 2007.

Interpretation of Trends: The upward population trend in the Landbird point data and habitat capability are expected since a majority of the Forest types are aging. The CompPATS program takes into account the conditions in all forest types and it factors in management practices including prescribed burning and thinning and these data also show an upward trend. The overall situation should continue to improve as the unmanaged hardwood and hardwood-pine and the managed pine stands age. The current habitat capability being able to support 14,647 birds exceeds the RLRMP population objectives of 11,265 (USDA Forest Service. 1995). The positive trend indicates this species is doing well.

Implications for Management: The pileated woodpecker and its habitat appear to be secure within the Forest. There are no indications of a need to alter management direction.

Scarlet tanager (*Piranga olivacea)*

The Scarlet tanager (*Piranga olivacea*) is a Management Indicator Species (MIS), selected to help indicate the effects of management on mature forest communities. This species favors mature hardwood, and hardwood-pine, and is less numerous in mature mixed pine-hardwood and pine habitat types. It is relatively common in all of these habitats in the Ouachita Mountains.

Data Sources: The Forest Landbird point data, North American Breeding Bird Survey (BBS) (Sauer et al. 2007, and habitat capability predictions using CompPATS, and Field Sampled Vegetation (FSVeg) data were used to make an assessment of trend.

Population Trends: The Landbird point data collected from 1997 – 2007 (Figure 4.20) indicate an overall positive trend for the scarlet tanager.

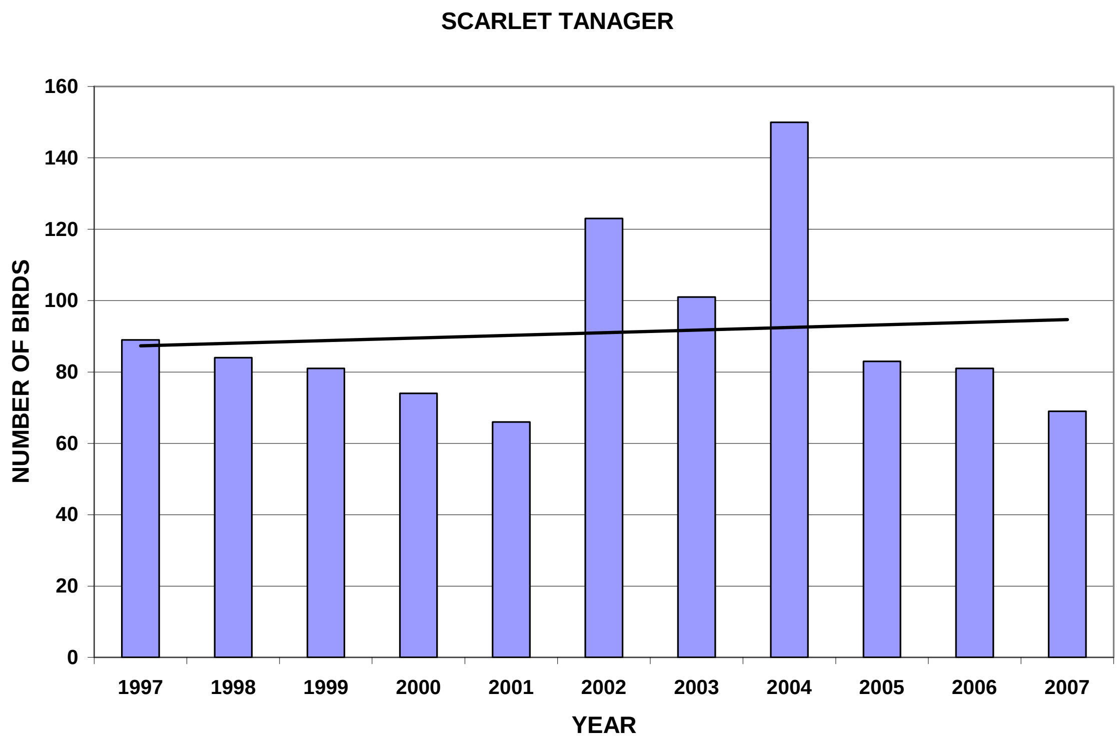

Figure 4.20—Scarlet tanager detected on Ouachita National Forest Landbird points 1997 – 2007.

The BBS data (Figure 4.21) indicate a nonsignificant increasing trend of 0.89 percent for 1966 – 2006, for the Ozark-Ouachita Plateau.

Forest Landbird point data, Breeding Bird Survey data and Habitat capability data all support and increasing trend for the Scarlet tanager.

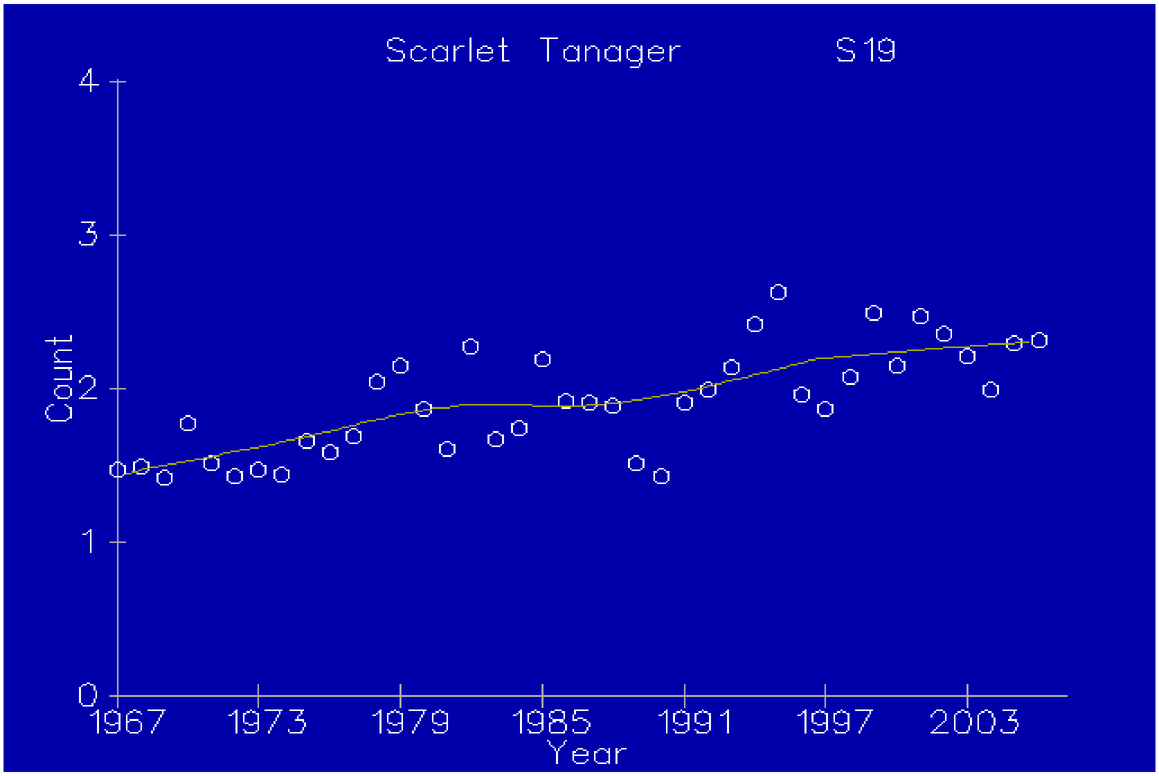

Figure 4.21—Scarlet tanager Breeding Bird Survey Trends for the Ozark-Ouachita Plateau 1966 – 2006.

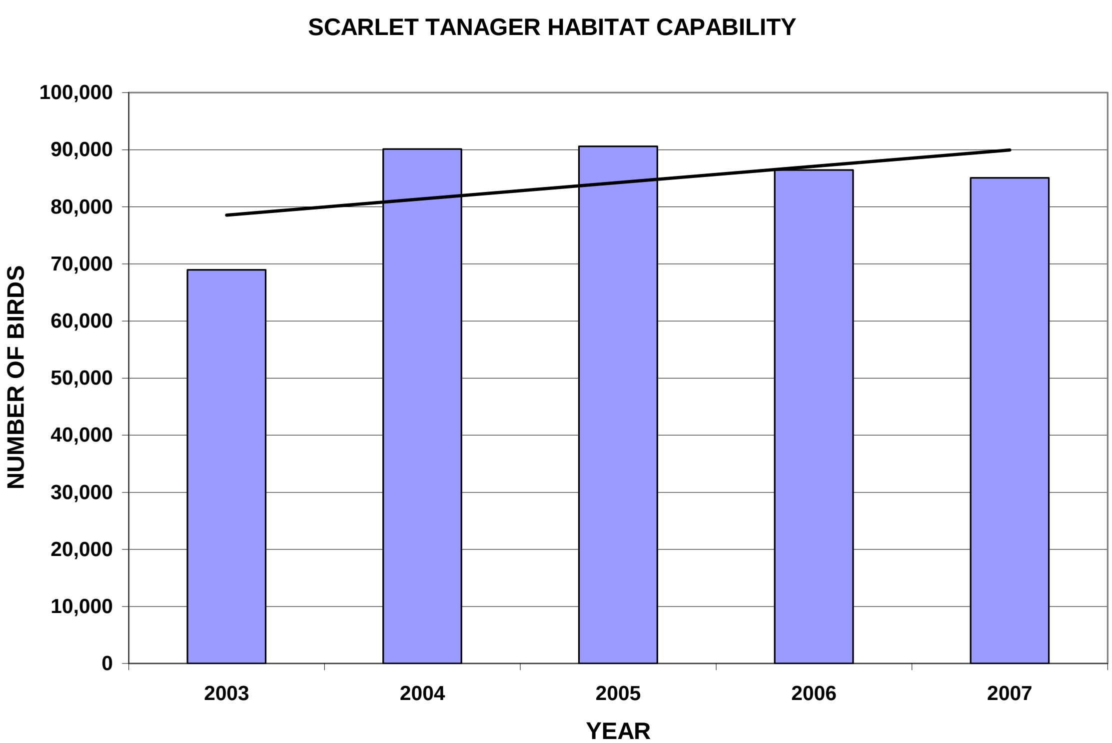

Figure 4.22—Scarlet tanager Habitat Capability trends for the Ouachita National Forest 2003 – 2007.

Interpretation of Trends: Data are supporting a conclusion of a nonsignificant increasing population trend on the Ouachita National Forest and the Ozark-Ouachita Plateau where mature hardwood and mixed types are represented. On the Forest, there are 479,958 acres of hardwood and hardwood/pine forest types greater than 41 years old that will continue to mature. In the pine and pine-hardwood forest types, many more acres are being managed under various treatments under uneven aged management which also serve as habitat.

Consequences for Conservation: This species and its habitat is secure within the Forest. The continued long-term viability of this species is not in question. With the maturing of over 479,000 acres of hardwood and hardwood-pine and designated pine old growth habitats, the continued availability of adequate habitat is secure.

Implications for Management: The scarlet tanager has a nonsignificant increasing population trend within the Ouachita National Forest and the Ozark and Ouachita Plateau and is secure within its overall range. Its viability as a species is not in question at this time. The scarlet tanager will be retained as a Management Indicator Species and monitoring will continue through the Breeding Bird Surveys, Landbird point counts and habitat capability monitoring processes.

Prairie warbler (*Dendroica discolor*)

The Prairie warbler (*Dendroica discolor*) is a Management Indicator Species (MIS) selected to help indicate the effects of management on the early successional component of forest communities. As a Neotropical migrant it is an international species of concern. This species uses early successional habitats such as regenerating old fields, pastures, and young forest stands. The vegetation selected may be deciduous, conifer, or mixed types. Habitats with scattered saplings, scrubby thickets, cutover or burned over woods, woodland margins, open brushy lands, mixed pine and hardwood, and scrub oak woodlands are most often selected.

Data Sources: The North American Breeding Bird Survey (BBS) (Sauer et al. 2007) indicating trend results for the Ozark - Ouachita Plateau, Forest Landbird point data (1997 – 2006), and the Habitat Capability data are sources for evaluating prairie warbler population trends.

Population Trends: The BBS data (Figure 4.23) indicate a significant declining trend of – 4.08 percent for both periods of consideration, 1966 – 2006 for the Ozark-Ouachita Plateau (S-19) as well as a 1.9 percent decline throughout its range survey-wide.

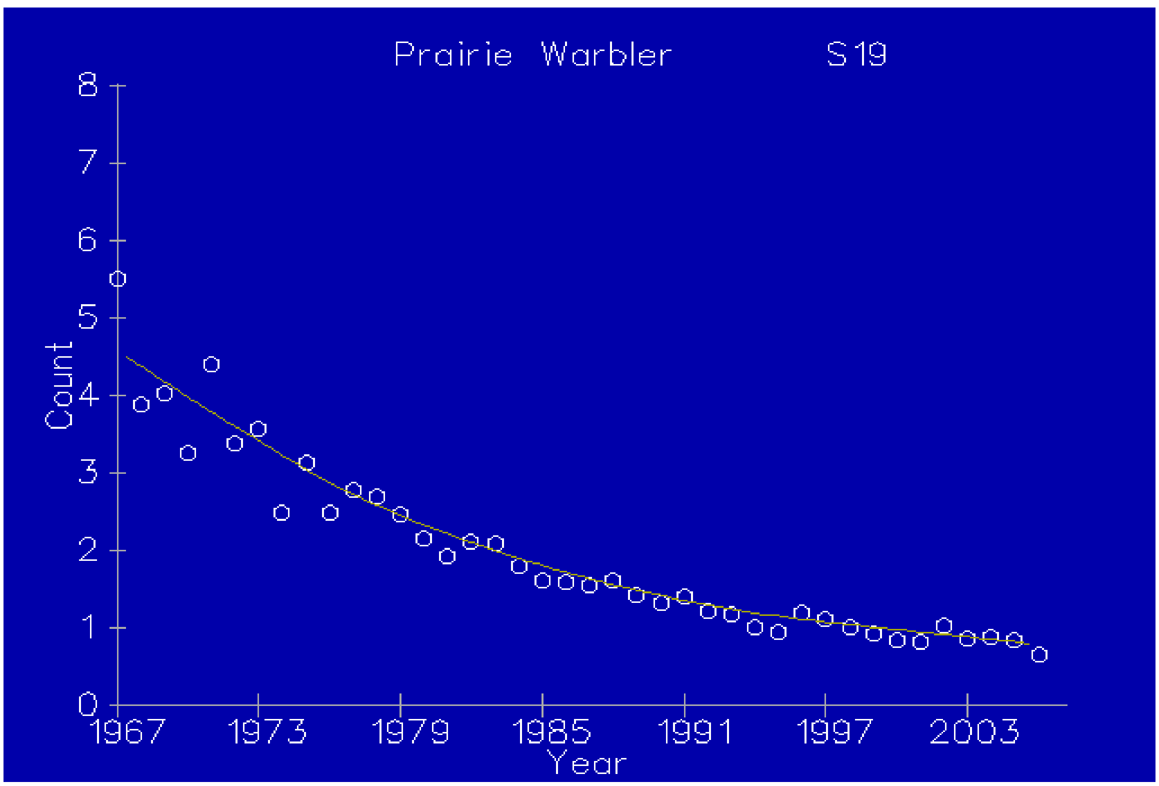

Figure 4.23— Prairie warbler Breeding Bird Survey population trend for Ozark-Ouachita Plateau for 1966 - 2006.

Based on the data available, the prairie warbler is in a downward trend. These data are in agreement with the BBS data for the Ozark-Ouachita Plateau and the same downward trend that is indicated throughout the prairie warblers' range nationwide.

Below, Figure 4.24 indicates the number of prairie warblers recorded on the Landbird point counts, and Figure 4.25, displays the Forest habitat capability. Both of these data are indicating a downward trend.

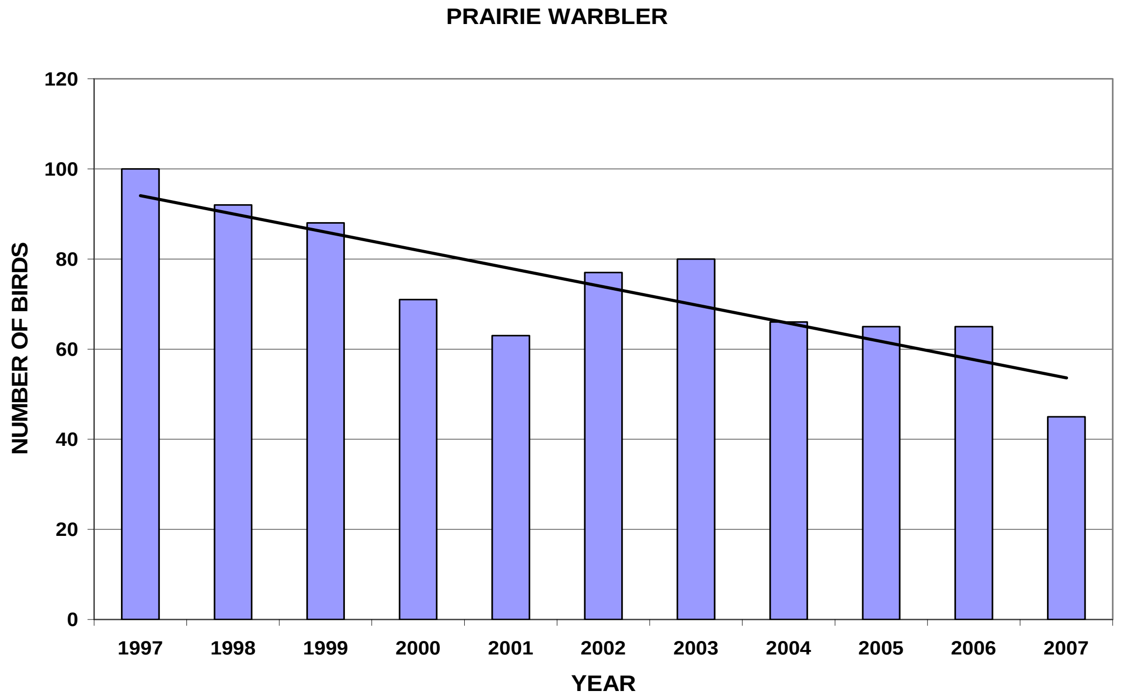

Figure 4.24—Prairie warbler detected on Landbird point counts, Ouachita National Forest 1997 – 2007.

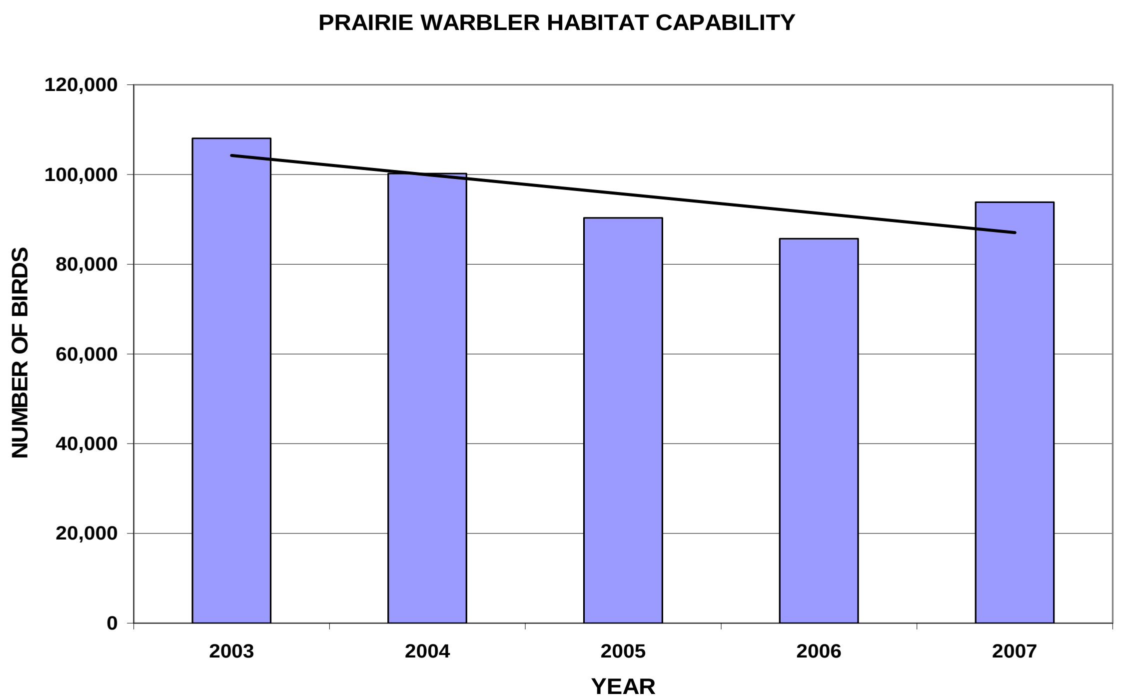

Figure 4.25—Prairie Warbler Habitat Capability trends for the Ouachita National Forest 2003 – 2007.

Interpretation of Trends: Data are supporting a conclusion of a declining population trend for the prairie warbler on the Forest and survey wide. This decline is considered to be directly related to the decline in habitat in acres of early seral habitat available.

The decline in early seral habitat has been recognized and was addressed in the Revised Land and Resource Management Plan. Forest management has gone from approximately 15,000 to 18,000 acres of clear-cutting per year in the later 1980's to a low of about 800 acres of seedtree / shelterwood cutting in 2002. The changes by year in the creation of early seral habitat in the pine and pine/hardwood management types are demonstrated in Figure 4.26.

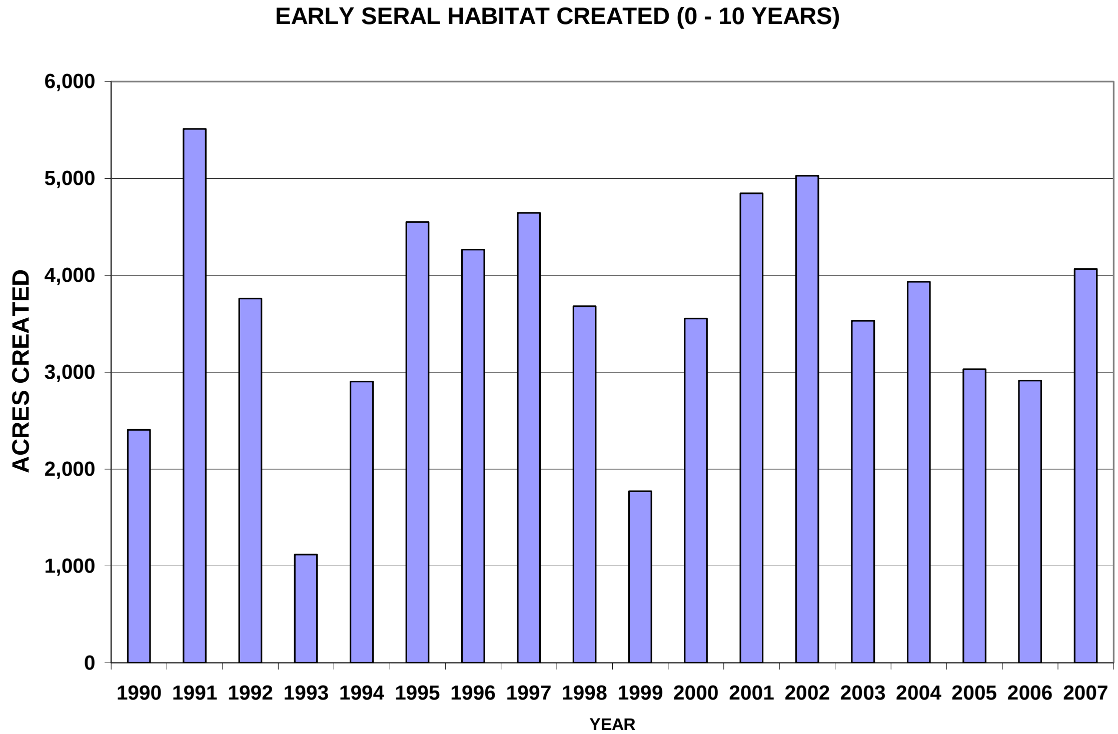

Figure 4.26—Acres of early successional habitat created by year 1990 – 2007, Ouachita National Forest.

Since the lowest level of early seral habitat created in 1993, this habitat is showing a slight improvement over the long term. The prairie warbler has demonstrated a decline for the past decade (Figure 4.24) and mirrors the decline of habitat capability depicted in Figure 4.25. Under the Revised Plan implementation, early seral habitat should continue to increase and then stabilize at approximately 50,000 to 60,000 acres after ten years (FEIS 2005, p175). The prairie warbler and its habitat will continue to be monitored.

Implications for Management: The prairie warbler has a declining population trend within the Forest and throughout its overall range. Although it has been declining, the population viability on the Forest should not be threatened. The population decline has been exacerbated by the fact that the quantity of early seral habitat expected to be produced annually (5,500 acres), largely by seed tree and shelterwood cutting, has not yet been realized. There will be a lag time between implementation of the Revised Land and Resource Management Plan and the appearance of additional early seral habitat and its associated prairie warbler response. In the meantime, increases in thinning and prescribed burning in the pine and pine-hardwood types, especially those associated with approximately 200,000 acres of shortleaf-bluestem ecosystem restoration, will benefit prairie warbler populations by improving habitat.

The prairie warbler will continue to be monitored through the Breeding Bird Surveys, Landbird point counts, and habitat relationship processes. Actions being taken to reverse its declining habitat and population trend will continue.

Chapter V: Summary and Conclusions

This document summarizes monitoring information for the MIS found on the Ouachita National Forest, and determines their status and conservation needs after more than a decade of Forest Plan implementation and monitoring. This summary (Table 5.1) concludes that no MIS species is at risk and population trends are generally as expected. Current management practices are adequate for maintaining viable populations of MIS with the noted exceptions. While adjustments could be made in the identification of some MIS, the current list is adequate until the ALRMP is revised.

Table 5.1—Summary of MIS Monitoring

Species	Expected Population Trends	Apparent Population Trends	Risk for Conservation of Species	Management Changes Needed
Stream Fishes				
Yellow bullhead (*Ictalurus natalis*)	Stable	Declining	None	Restrict OHV use, maintain roads and trails
Longear sunfish (*Lepomis megalotis*)	Stable	Stable	None	None
Creek chubsucker (*Erimyzon oblongus*)	Stable	Stable	None	None
Green sunfish (Lepomis cyanellus)	Stable	Increasing	None	Restrict OHV use, maintain roads and trails
Central Stoneroller (*Campostoma anomalum*)	Stable	Increasing	None	Restrict OHV use, maintain roads and trails
Pirate perch (Aphredoderus sayanus)	Stable		None	None
Redfin darter (Etheostoma whipplei)	Stable	Stable	None	None
Johnny darter (Etheostoma nigrum)	Stable	Stable	None	None
Channel darter (*Percina copelandi*)	Stable	Stable	None	None
Northern hog sucker (*Hypentelium nigricans*)	Stable	Stable	None	None
Northern studfish (*Fundulus catenatus*)	Stable		None	None
Orangebelly darter (*Etheostoma radiosum*)	Stable	Potentially Decreasing	None	Restrict OHV use, maintain roads and trails
Striped shiner (Luxilus chrysocephalus)	Stable	Stable	None	None
Smallmouth Bass (Micropterus dolomieu)	Stable	Stable	None	None
Lake and Pond Fishes				
Redear sunfish (Lepomis microlophus)	Stable	Increasing	None	None
Bluegill (Lepomis microchirus)	Slight decline	Stable to slight decline	None	None
Largemouth bass (Micropterus salmoides)	Slight decline	Stable to slight decline	None	None
Terrestrial Vertebrates				
White-tailed deer (Odocoileus virginianus)	Decreasing	Increasing	None	None
Northern bobwhite (*Colinus virginianus*)	Decreasing	Increasing	None	None
Eastern wild turkey (*Meleagris gallopavo*)	Stable	Increasing	None	None
Red-cockaded woodpecker (*Picoides borealis*)	Increasing	Increasing	None	None
Scarlet tanager (*Piranga olivacea*)	Stable	Increasing	None	None
Prairie warbler (*Dendroica discolor*)	Decreasing	Decreasing	None	None
Pileated woodpecker (*Dryocopus pileatus*)	Stable	Increasing	None	None

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Appendix

A. Basin Area Stream Survey Procedures

Following is the methodology for the Basin Area Stream Survey (BASS) inventories. This section is in large part reproduced from USDA Forest Service, Ouachita National Forest (1994) report.

Local Descriptions: Three ecoregions were studied within the ONF uplands. Within each ecoregion, two watersheds were selected based on past management activities, comparable size, ownership, and proximity. Watersheds containing little or no timber harvesting activities served as reference basins, and watersheds with harvesting activities typical of the ONF represented managed basins (Table 1). Candidate watersheds were large enough to support a resident fishery, were primarily in National Forest ownership, and were proximal to the other watershed within the ecoregion.

Table A.1—Surveyed watersheds, by ecoregion, length, area and management emphasis

Stream Name and Ecosystem	Kilometers (Miles)	Hectares (Acres)	Reference/ Managed
Upper Ouachita Mountain (UOM)			
S. Alum Creek	7.7 (4.8)	1,533 (3,789)	Reference
Bread Creek	8.5 (5.3)	1,517 (3,748)	Managed
Lower Ouachita Mountain (LOM)			
Caney Creek	13.5 (8.4)	2,170 (5362)	Reference
Brushy Creek	8.8 (5.5)	2,938 (7,261)	Managed
Arkansas River Valley (ARV)			
Dry Creek	9.1 (5.7)	2,518 (6,222)	Reference
Jacks Creek	7.0 (4.3)	3,428 (8,470)	Managed
Total	54.6 (33.9)	14,104 (34,852)	

All watersheds were inventoried 1990 in and reinventoried in 1991, 1992, 1996, 2001 and 2006. Data were collected in late spring and summer. Two, three-person crews inventoried a stream pair for physical characteristics, once both streams were completed the crews would combine and sample fish, aquatic invertebrates, flows and chemical components.

Physical: Physical inventories began at the downstream end of each watershed. Reaches corresponded to habitat types and were numbered consecutively beginning with one. A list of habitat types and codes is in Appendix A. The minimum reach identified was ten meters in length. Individual stream reaches were flagged and labeled with the reach number and habitat type. Habitat types were coded according to McCain and others (1990). The length and width of each reach were measured to the nearest tenth of a meter. Bankfull width was visually estimated to the nearest meter.

A transect of depths was measured to the nearest centimeter. The transect measurements were taken at the waters edges and at one quarter, half, and three quarters of the width. In addition, the depth at the thalweg was measured to the nearest centimeter. All widths and depths were measured at the midpoint of the reach or habitat type. For example, if a reach is 12 meters long the width is measured at six meters.

Substrate material was measured at the mid point of the reach with 10 samples and expressed as a percentage of the reach. Substrates were classified as bedrock, boulder (>30 cm), cobble (8-30 cm), gravel (8-1 cm), sand (1 cm-0.5 cm) and fines (<1 mm) following a modified Wentworth scale (Bovee and Cochnauer, 1977). Embeddedness was estimated as the average percent of cobble-sized substrate surrounded by fines.

Cover for fish was estimated as a percent of the habitat area. Categories included undercut banks, large woody debris (diameter >0.15 m, logs and rootwads), small woody debris (diameter <0.15 m), terrestrial vegetation overhanging the stream (height <0.3 m), white water, boulder (diameter >30 cm), bedrock ledges, vegetation clinging to the substrate, and vegetation rooted in the stream substrate (Platts and others, 1987).

Bank angle was measured in degrees with a clinometer on each bank. For example, vertical banks were 90°, undercut banks were less than 90° (Platts and others, 1987). Bank stability was estimated for each bank as a percent of the bank intact and/or non-erodible. Terrestrial vegetation was classified as brush, grass, forest, or barren. Canopy closure was measured using a spherical densiometer while facing upstream in the middle of the reach and recorded as the percent of vegetation closure.

Chemical: Chemical and flow data were collected in the same areas that were sampled biologically. Dissolved oxygen (DO) and temperature were measured in the field. Water samples were collected and preserved for analysis. Water analysis included alkalinity, conductivity, pH, and nitrates.

DO was determined through a meter or the winkler method. Samples were analyzed at the Northeastern Forest Experiment Station at Berea, KY. Samples were analyzed using EPA Methods for Chemical Analysis of Water and Wastes (1983).

Biological: The biological inventory was based on sampling 10 percent of all stream reaches typed. For example, if 30 mid-channel pools were identified within a stream then three mid-channel pools were sampled. Sampled reaches were stratified along the length of the stream.

For fish collections, the habitat reach was isolated with block nets. Collections were made using the multiple-depletion method of Van Deventor and Platts (1985). This involved at least two and preferably three or more shocking passes through the sample area. These passes covered the reach in an upstream progression with consistent effort on all passes. The downstream block net was surveyed for fish after every pass and captured fish were included with that pass. Each pass comprised a sample and was placed in separate containers. Fish were preserved in 10 percent formalin. Game, endangered, threatened, or sensitive species were measured and weighed in the field and returned to the stream. The identification, sorting and measurement of collected fish was conducted at Northeast Louisiana University and the specimens placed in their museum facility.

Aquatic macroinvertebrates were collected with a five minute traveling kick net sample, using the same reaches sampled for fishes. Reaches were sampled as the collector shuffled or kicked the substrate with the dip net positioned directly downstream. All microhabitats (woody debris, leaf packs, etc.) within the reach were included in the sample. At the completion of the five minute kick sample an additional five minute sample from washed substrate was taken. The dip net was placed downstream and individual cobbles were scrubbed with a soft bristle brush into the dip net. That sample was combined with the kick net sample. Large organic debris and leaves were washed and removed from the sample. Aquatic macroinvertebrate samples were preserved in 70 percent ethanol (Merritt and Cummins, 1984). The sorting and identification of organisms collected were contracted separately and placed in a permanent museum facility at Arkansas State University.

B. Objectives and Methodology for Other Forest Stream Monitoring Sites

Several Long-Term Stream Sampling Records (L-TSSR) have been established within the Ouachita National Forest since 1995. These monitoring sites are located primarily in the Ouachita Mountain Ecoregion where most of the threatened, endangered and sensitive fish species are known to occur. In most cases these monitoring sites have been sampled annually. A modification of the Basin Area Stream Survey (BASS) methodology (Clingenpeel and Cochran 1992) has been used at these sites to collect physical and biological water quality data. The purpose of this sampling is to collect baseline fish data, to observe water quality variables at these sites through time, to determine if these physical and biological variables fall within the range of natural variability, and to monitor management indicator species (MIS) population trends. In watersheds planned for timber harvest activity, another objective is to monitor the effects of management activities on stream integrity. The data collected in this other stream sampling effort are currently being entered into a database that will be incorporated into the Forest Geographic Information System. This will allow generalized use and further analysis of the data.

A sample reach includes two consecutive riffle-pool sequences (four habitat reaches) with a total length of 100 meters at least. Macroinvertebrate sampling consists of five minutes of kick sampling throughout a riffle or run habitat within the sample reach using a D-frame kicknet. Specimens are collected from the net and from the accumulated rocks, gravel and organic matter. Specimens are sorted using the Issac Walton league SOS technique, then preserved in a 50% alcohol solution. The SOS technique is a simple procedure that accomplishes a cursory water quality evaluation by sorting insects into three categories based on their sensitivity to water pollution. More specific identification of the aquatic macroinvertebrates is currently being conducted at the University of Central Arkansas.

Physical habitat is assessed at other monitoring sites using BASS methodology. Habitat types are determined using the Ouachita National Forest Habitat Typing Field Guide. Measurements are obtained for habitat length, width, and depth. Substrate composition and instream and riparian cover characteristics are described. Temperature and conductivity are obtained with Oakton meters or similar equipment. Alkaliny and pH are obtained with LaMotte or Hach kits.

Fish are sampled using a Smith-Root battery powered backpack electrofishing unit. One person operates the unit and one or two persons net the stunned fish. The fish are identified, counted, and released.

C. Objectives and Methodology for Johnny and Channel Darter Sampling

Johnny and channel darter data are derived from the annual leopard darter monitoring being conducted jointly with the US Fish and Wildlife Service's Tulsa Ecological Services Office. Data used in this MIS analysis are from the 1998 through 2007 long-term monitoring site surveys for leopard darters. While data are available from more sites dating back to 1992, techniques and darter identifications weren't as refined. Individual data sets for the earlier years, when fully received from the FWS, will be examined for their reliability.

During the late 1990's it was decided that there was a need to select monitoring sites in each drainage that would be sampled annually by the most experienced personnel and this effort was added as a second week in 1998. Prior to that time a large crew was assembled for a week of range wide surveys at new and old survey sites. This crew consisted of two co-leaders one each from the Forest and the FWS with additional agency (FS and FWS) personnel, state agency personnel (Arkansas Game and Fish Commission and Oklahoma Department of Wildlife Conservation) and volunteers. Crews ranged in size from 5 to 15 individuals of varying swimming and snorkeling abilities and most had little underwater fish species identification experience. The turnover in the crews from year to year was high.

The same techniques and protocols for the early surveys are used by the smaller monitoring team composed of five snorkelers and each of the permanent monitoring sites has been roughly mapped and broken into five transects. Each snorkeler takes a transect and does a timed count. Year to year the same transect is often surveyed by the same individual but that is not necessarily always the case because of changes in personnel that have occurred over the years.

Transect length, width and depth vary by site. Depths are generally in the two to four foot range but may run as deep as six to eight feet. The deeper water is not searched as intensely as the shallower waters when snorkeling due to breath limitations. SCUBA has been used once at each of three sites for the deepest permanent transects with dive times and counts handled the same as for snorkeling (two sites in 2002 and one site in 2004 and only two of the five transects at each site). Our working assumption is that snorkeling counts and SCUBA counts are equivalent.

Transects are snorkeled on the long axis with side to side sweeps resulting in approximately 50% coverage of each transect. Dive time is recorded by transect/diver with individual counts of leopard, channel, Johnny and orangebelly darters, logperch, sunfish and bass. Dive or count time is the time to complete the transect, not a set length of time. The counts for sunfish and bass are often estimated when large numbers are encountered. The focus of these counts in the past was to gather data on population trends of just the leopard darter. The other fish species counts were requested in an effort to encourage more accurate identifications of the fish encountered. By using data only from the more experience core team, the channel and Johnny darter separations are considerably more accurate than including counts from the larger crews.

For several surveys in the earlier years, an individual's counts for channel and/or Johnny darter were recorded as NC (no count). In those cases, that snorkeler's time for that site was dropped so counts per time are for only those snorkelers recording counts for these two darters.

Besides the darter counts, water and air temperature, total dissolved solids, and conductivity are taken at each site using a Hach conductivity meter. Maximum depth in meters and secchi disk reading are also recorded. The latter may be the same as the maximum depth should visibility be greater than depth, in which case the secchi depth is recorded as depth+. Because the secchi depths are not the maximum depths at the very clear sites, these measurements could not be statistically treated in the analyses. At each permanent monitoring site a water sample is generally taken and preserved for later nephelometric analysis to measure turbidity and clarity of the water samples. While this reading is an accurate description of the incidental scatter of a beam of light through the sample, it is not a totally accurate description of viewing conditions at the time of collection. The amount/intensity of sunlight hitting the water surface and the time of day/refractive angle of the light also influences how well the snorkelers can see fish and separate by species. We recently added a horizontal secchi disk reading conducted underwater in an effort to better describe viewing conditions but have insufficient data to make any correlations with other data sets at this time.

Because of concerns with the variances between individual's coverage of an area, speed of search and in general, overall performance of the visual counts and how they can be applied as a population size measurement/index, a method of comparing visual counts to a population estimate was made. In 1997, two fish depletions were conducted. Transects were blocked with fine-mesh seines and the monitoring crew snorkeled the section making their typical timed counts. After the counts were made and tallied, multiple electrofishing passes were made through the blocked section collecting all species of fish present. Even using two backpack electrofishers simultaneously, capture rates were quite low for all fish species and excessive leopard darter mortality occurred. In 1998, the depletion was done by repeated swimming passes through the blocked section of the stream using aquarium and small mesh hand held dip nets to capture only leopard darters until a good depletion curve was achieved (generally 5 to 7 passes). This method has resulted in no leopard darter losses. Comparison of snorkeling counts for leopard darters and population estimates indicates that the snorkeling observations account for 18 to 25% of the actual population estimate with 20% being the most common value. These two depletion sites have been resampled annually since 1998 and the swim-through snorkel counts are in the data sets being analyzed for MIS trends.

Whether the snorkel count figures for Johnny and channel darter would amount to 18 to 25% of these two darter populations at any site is unknown. Johnny and channel darters have proven to be much more elusive to capture and it is doubtful a good depletion could be obtained. For trend purposes, without any major shifts in techniques, use of the snorkeling counts is the only practical way of monitoring populations of these species without electrofishing and thereby running the risk of killing leopard darters.

D. Lentic MIS Sampling Methodologies

Sampling data presented in the Lentic MIS write-up is from lake and pond electrofishing. Sampling methodologies originated from the Arkansas Standardized Sampling Procedures Manual adopted March 1, 1988 by the Fisheries Division of the Arkansas Game and Fish Commission (AGFC). The Forest modified these electrofishing methods somewhat. In the last seven years, the Oklahoma Department of Wildlife Conservation (ODWC) developed a set of sampling protocols (undated) and in 2006, AGFC updated their manual.

Due to the small size of the Forest lakes and ponds being sampled, the new AGFC's protocols on sample durations and randomizing shoreline reaches to be sampled aren't applicable to Forest. Most Forest samples consist of one pass around the full or nearly full shoreline of each waterbody and time durations are not a factor unless three or more uniform sample periods can be accomplished with enough fish caught to make it worthwhile to break up the sampling period. All of the Forest ponds and several of the lakes are under 7 acres and are sampled in one continuous run along the shoreline deep enough to run the electrofishing boat. Lakes over 25 acres are usually sampled in three runs or more of 10 minute pedal-down time duration for the AGFC protocol and Cedar Lake is done with a 15 minute pedal-down time duration as called for in the ODWC protocol.

These lake and pond data sets are also used annually in preparation of the Forest's Annual Monitoring and Evaluation Report. Largemouth bass, redear sunfish and bluegill statistics are the main focus for the reasons discussed in the body of this MIS report. Previous analyses have been on a water body by water body basis, which is the appropriate scale for determining fish population and fish habitat management needs.

Historical perspective of equipment and sample periods

The Ouachita National Forest began electrofishing lakes and ponds on the Forest in the fall of 1991 utilizing an 18-foot aluminum flat-bottomed boat with a 6000-watt Onan generator and a Coffelt Model VVP-2E variable voltage pulsator. Anode probes on the front of the boat consisted of a single aluminum bar connected to the end of both booms with six stainless steel whip antennae that extended from the bar into the water. These antennae were six foot long but extended no more than five feet into the water. Daytime sampling was conducted that year because the lights on the boat didn't work. In the spring of 1992, the lights were rewired on the original boat and nighttime sampling began. The aluminum bar with whip antenna probes was replaced with five, 6-foot-long, ¼ inch stainless steel cables that extended from the end of each of the two booms though an 18 inch aluminum spreader in an "x" configuration, with one cable extending below the center of the "x" spreader. Depending upon the weight on the bow of the boat, the spreader bars were in or just above the water. In 1991 and 1992, pulsed AC current was used, as the DC conversion was not working correctly on the pulsator. The total catch of all fish increased significantly in 1992 as the result of the switch to nighttime sampling and increased electrical field strength with more anode surface in the water. The latter was never actually measured but is based on electrical theory and observations of stunned fish occurring further from the probes than with the original antenna probe configuration. No fall sampling took place in 1992. The shift from fall to spring sampling did result in some differences in individual species catches across the Forest. Bluegill catches are typically more variable in the spring than the fall depending upon whether they have moved into the shallows to spawn or whether we sampled too early and the larger bluegill are still in deeper water offshore.

Prior to the 1993 spring sampling, a new boat, trailer and generator were purchased and a new electrofishing rig was built using salvaged equipment from the original boat. In addition, a second Coffelt Model VVP-2E variable voltage pulsator was acquired as a spare and the first unit was repaired, restoring pulsed DC capability. The steel cable configuration was maintained for the anodes and paint was sanded off a portion of the bow of the boat to improve cathode efficiency. Nighttime sampling remained the predominant sampling time but travel logistics required a couple of daytime samples. Catch rates went up remarkably with the new equipment.

In 1994, because of growing logistic and safety concerns, daytime sampling became the standard with two exceptions to date. In 1995, the AGFC sampled Little Bear Creek with their equipment and our assistance utilizing their full protocol, which includes nighttime sampling. By prior agreement, the Forest processed all the data and this sample is included in the Forest's database for electrofishing. The one other nighttime sample since 1994 is the spring 2000 nighttime sample at Kulli that occurred after a number of extremely poor daytime catches after 1996. It was determined that nighttime sampling at Kulli could produce much better catches but a follow-up fall 2000 daytime sample indicated similar results could be achieved in daylight but in the fall rather than the spring. In spring, 2004, the Forest assisted the AGFC with a nighttime sampling at Cedar Creek Lake but that sample is not in the Forest's database since the AGFC entered the data. It was a collection of only bass and bluegill and a rather poor one at that as we sampled too late in the season. Nighttime sampling has continued to be the exception.

In 1994, fall sampling was added when it became apparent that more lakes and ponds were being added to the sampling schedule than would fit the window of sampling temperatures specified in the AGFC protocol. The focus of the fall sampling is the Forest's smaller lakes and ponds with the larger waters sampled in the spring. Kulli Recreation Area Lake, as discussed above has been moved from the spring sampling schedule to the fall sampling period. North Fork Lake is sampled both spring and fall utilizing classes from Ouachita Baptist University mostly because of the availability of help and the professor's request to get as many classes out in the field as possible.

Because of concern over the weathering of wiring and connections on the electrofishing boat and a broken boom, the boat was completely rewired and new fiberglass booms were installed prior to the fall 2001 sampling season. However problems were encountered during the fall period as the electrical feed line from the generator to the transformer was miswired and the control box was only receiving 110 volts instead of 220 volts AC. The problem was found after the first couple of fall outings and fixed. These waters were resampled. Amperages since the boat was rewired have been consistently one to three amps lower than before. The most plausible explanation is that the amperage difference was from resistance due to bad connections and/or insufficient wire gauge size to carry the currents developed from the control box. A change in efficiencies of capture and fish reactions to the electrical field was not observed.

Prior to the 2004 field season the Coffelt control box unit was replaced with a Smith-Root Type IV-A control box and the boat was rewired for this new unit. The probe droppers were also reconfigured to three cables on each probe spaced one at the tip of the probe and then about 12 inches apart back toward the boat. These two changes more closely approximate the gear used by the ODWC and AGFC. Due to the logistics of swapping out the equipment on the same boat, there was not a suitable means of comparing efficiencies between the two units. The change from Coffelt equipment was necessitated because of its age and increasing difficulty in securing parts/repairs since the manufacturer had gone out of business, not because of efficiencies of the Coffelt unit when it was working.

Just prior to the fall 2005 sample, the aluminum boat was replaced with a new heavier, but similar, model of aluminum boat. The probes, wiring and control box were switched between the boats with no alterations. Again, changes in efficiency between the units could not be tested but no differences have been noted. Prior to the fall 2007 sample, a larger outboard was installed on the shocker boat. This modification would have no affect on electrofishing efficiency. As the result of this heavier gauge aluminum boat, a bit more effort has been expended working thick standing timber and areas with abundant stumps. This could lead to slightly lower catch per hour rates and improvements in PSD and PSD-P as the larger fish hang out in the heavier cover but at lower densities. Additionally due to reduced maneuverability in the heavier cover, pedal-down times per distance are slightly longer than in more open cover or along open shorelines. These changes are too subtle to be tested and are just part of the sampling variability that can not be totally eliminated.

Sample timing (AGFC protocol with USFS modifications)

Electrofishing samples will be conducted on the basis of water temperature measured at least 0.5 meters below the surface. The acceptable temperature range for electrofishing black bass species will be 10-21 degrees C (50-70 degrees F). The optimum range for largemouth bass is 15-20 degrees C (59-68 degrees F). Electrofishing effort should be concentrated in the optimum range. Fall electrofishing is optional. All procedures are the same as with the springtime electrofishing. All sampling should be performed between sunset and sunrise, unless circumstances require sampling to be performed during the day (AGFC 1988).

As noted above, fall sampling is now a standard procedure and daytime electrofishing is also our standard. In addition, because of the scheduling of assistance from the Ranger Districts and the required 48 hours notice to the state wildlife officers for both Arkansas and Oklahoma, a schedule is generally sent out two weeks prior to the commencement of sampling. This schedule is adhered to regardless of water temperature with the only cancellations due to rain or thunderstorms in the area. If sampling starts with water temperatures too cool, sampling stays on schedule but the early lakes may be added back into the schedule at the end of the sampling season for a second sampling. The small waterbodies the Forest is sampling can warm or cool faster than the sampling program can respond without compromising the number of lakes and ponds sampled annually. The intent is to sample the desired number of lakes and ponds and sample one or more of them twice during the season, as scheduling allows, to develop a feel for temperature effects.

Sampling effort (AGFC protocol with USFS modifications)

If the lake is 405 hectares (1000 acres) or less, then: Collect all bass shocked, but collect a minimum of 100 stocked-size bass of the target species (AGFC 1988). All species and all sizes of fish are collected during Ouachita NF electrofishing. Because of the small size of our Forest lakes and ponds, area covered is the deciding factor for stopping, not the number of fish per species caught.

Collect a minimum of 100 bluegill at least 75 mm in total length. Effort should be made to collect a sufficient number of bluegill to produce a representative length-frequency histogram (AGFC 1988). As noted above, all species and all sizes are collected during Ouachita NF electrofishing and area covered is the deciding factor for stopping, not the number of fish per species caught.

Sample a minimum of 5.0 hours actual fishing time if minimum quota cannot be met, or one complete circuit of the lake (AGFC 1988). With the small Forest lakes and ponds, one circuit is the cutoff (or impending foul weather). With a 16-foot boat with booms extending an additional 6 feet, maneuvering in dense flooded timber becomes a human and equipment safety problem so dense flooded timber is generally avoided or not penetrated very far.

An entire lake is considered one sample. Concentrate efforts in areas of known bass habitat (AGFC 1988) which has since been modified to randomly selecting shoreline reaches sampled with a 10 minute pedal-down duration. The Forest’s procedure is to run one complete circuit of the 2 to 8 foot deep portions of the lake or pond’s shoreline readily accessible to electrofishing. This may range from 40 to 100% of the shoreline for any particular waterbody. All habitats except deep open water are sampled in the proportion they occur except for dense flooded timber and shallow mud flats. Constructed brush and tree fish attractors in less than 10 foot of water are searched for and shocked when found. Searching time is generally spent without the electrofisher running with pedal-down, so electrofishing time spent is only that while over the structure once it is found.

Sampling procedure (AGFC protocol with USFS modifications)

Record header information on the Electrofishing Sample Field Form for each night (day) of sampling. Sampling will be conducted in 30-minute sub sample units, with all fish being worked up and recorded after each sampling unit. Record pedal-down time for each 30-minute unit, if available (AGFC 1988) and now 10-minute period under the new procedure as applicable. For some of the smaller waters, or when there are low fish catches and the fish are doing well in the livewell, sample time may be extended to as long as 30-50 minutes in order to complete the sampling if three 10-minute runs would result in more than one complete circuit of the lake/pond or very low numbers of fish are being taken. Recording sub sample time is essential to the calculation of catch rate statistics used in data interpretation. At the request of the ODWC, 15-minute sub sample units are the standard for Oklahoma waters. For North Fork Lake, in order to maximize the use of students, a 10-minute sample unit has been the norm so as to maximize the number of students that can be taken out for the larger classes. Since most of these waters are sampled in their entirety, length of sampling period should not affect sampling efficiencies or results.

Electrical settings

In order to provide some consistency in sampling, and hopefully catch rates, an attempt is made to keep the electrical output amperage between 4.0 amps and 7.0 amps. Adjusting the voltage and pulse width to achieve these meter readings does this. Voltage is generally adjusted first with the pulse width kept at a setting of 4. If the DC voltage is maxed out at 1020 volts (1061 volt on the Smith Root unit), then pulse width is adjusted upwards to achieve a 4.0 amp reading or higher. For the few lakes and ponds with conductivities in excess of 50 micro-ohms, two to three anode cables of the five per boom were lifted from the water and tied off which then allowed the voltage and pulse width settings and the amperage reading to stay somewhat consistent with that of the lower conductivity waters with the former setup. Lifting the cables also reduced the frequency of pulsator overloads in the shallowest water. Voltage is adjusted downward to keep from tripping the breaker for those ponds with higher conductivities. Since the probes were switched to just three cables per boom, lifting of cables to compensate for higher conductivities no longer takes place. In the most recent update to their sampling protocol, AGFC provided a temperature/voltage times amperage chart for standardizing power at 3000 watts. The target wattage is not achievable at the few lakes with high conductivities as the unit's breaker is repeatedly tripped but this does give a suitable target voltage/amperage setting to work toward for further standardization.

Discussion

A major difference between the AGFC methodology and the Forest's is our collecting all species and all sizes. This could reduce the efficiency of adult bass and bluegill capture to some extent. However, human nature being as it is, the larger fish usually are selected/captured first so the differences should be minimal. The fact that the Forest's catch rates per hour is for all sizes may even out the differences. The Forest's assessment is that looking at the full fish population, not just adult game fish, gives a more complete picture of the population dynamics of the lakes and ponds and is worth the extra effort in fish handling and data entry.

Probably of equal or greater significance is the AGFC's nighttime sampling versus our daytime sampling. Another important difference is that the Forest Fisheries Biologist only pilots the Forest's electrofishing boat and the netting crew consists of non-fisheries personnel including volunteers with experience ranging from none to many years of netting experience. While the AGFC may utilize volunteers, it is more common for them to have two experienced fisheries biologists on board that have been sampling the same water body for years. The Forest's shift to daytime sampling using whoever is available may result in lower catch rates than that seen with AGFC sampling but most of our data comparisons are with just Forest collected data so this is not seen as a problem. However, these differences need to be considered when comparing Forest to AGFC data.

All electrofishing data are entered into a computer program provided by the AGFC. The program provides a length histogram, relative weight statistics, length-weight equation and graph, relative and proportionate stock density and catch rate statistics by species, as well as a summary sheet of sampling conditions. A copy of the full printout and the field forms are provided to the Ranger District and the appropriate state fisheries biologist. A computer disk of the complete database is provided to the AGFC fisheries division annually.

Catch per hour data are computed based on the total seconds that electricity is applied to the water during each sample run (pedal–down time), not the clock time spent on the water. Table B.1 displays annual sample times by MIS. The times are different for the various species as there is one 1995 sample that was a bass and bluegill only collection conducted by an AGFC biologist with Forest assistance. Also included is the 1996 sample that was a bass-only sample for purposes of capturing and moving some marked bass between Cedar Lake and Crooked Branch Lake in Okalahoma. Catch statistics were collected during that sample to document the sizes of the newly stocked yearling bass.

Table B.1—Electrofishing annual sample duration time by MIS

Species/Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Time in **seconds** for **redear sunfish**	14,907	24,864	26,348	30,991	20,428	23,314	23,308	17,741	25,890	29,866	33,455	31,679	43,169	46,690	37,422	37,692	41,019
Time in **hours** for **redear sunfish**	4.14	6.91	7.32	8.61	5.67	6.48	6.47	4.93	7.19	8.30	9.29	8.8	11.99	12.97	10.40	10.47	11.39
Time in **seconds** for **bluegill**	14,907	24,864	26,348	30,991	23,552	23,314	23,308	17,741	25,890	29,866	33,455	31,679	43,169	46,690	37,422	37,692	41,019
Time in **hours** for **bluegill**	4.14	6.91	7.32	8.61	6.54	6.48	6.47	4.93	7.19	8.30	9.29	8.8	11.99	12.97	10.40	10.47	11.39
Time in **seconds** for **largemouth bass**	14,907	24,864	26,348	30,991	23,552	24,272	23,308	17,741	25,890	29,866	33,455	31,679	43,169	46,690	37,422	37,692	41,019
Time in **hours** for **largemouth bass**	4.14	6.91	7.32	8.61	6.54	6.74	6.47	4.93	7.19	8.30	9.29	8.8	11.99	12.97	10.40	10.47	11.39

The following table gives the sampling years and frequency of sampling for each lake and pond sampled from 1991 through 2007 that resides in the Forest's database.

Table B.2—Electrofishing sample frequency by year

Lake	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Totals
Bear Pond	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	1	2
Boney Ridge Pd	ns	ns	ns	ns	ns	ns	ns	ns	ns	1	ns	1	ns	1	ns	1	1	5
Cedar	ns	1	1	ns	ns	1	ns	2	1	2	2	1	2	3	1	1	1	19
Cedar Cr	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	1	2	1	ns	1	1	1	9
Cove	ns	1	1	1	1	1	1	1	1	ns	1	1	1	ns	1	1	ns	13
Crooked Br	ns	1	1	1	1	1	1	1	1	1	1	1	1	ns	1	1	1	15
Dry Fork	ns	ns	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	16
Hunter's Pool	1	ns	1	1	1	ns	ns	ns	ns	ns	1	1	1	1	1	1	1	11
Huston	ns	1	1	1	1	1	1	1	1	1	2	1	1	1	ns	1	ns	15
John Burns Pd	ns	ns	ns	1	1	1	ns	ns	ns	ns	ns	1	1	ns	ns	ns	1	6
Kulli	1	1	1	1	1	1	1	1	1	2	1	1	1	ns	ns	ns	1	15
Little Bear	ns	ns	ns	ns	1	1	1	1	1	ns	1	ns	1	ns	1	ns	1	9
Macedonia Pd	ns	ns	ns	1	1	1	1	ns	2	1	1	1	1	1	1	1	1	14
Midway Store Pd	1	ns	ns	1	ns	ns	1	ns	ns	ns	ns	1	ns	ns	1	ns	ns	5
Moss Creek Pd	ns	ns	ns	ns	1	1	1	ns	1	1	1	1	1	ns	1	1	1	11
North Fork (SF#3)	ns	1	1	1	1	1	2	ns	2	2	3	3	2	4	2	4	3	32
Old Forester Pd	ns	ns	ns	ns	ns	ns	ns	ns	2	ns	1	1	ns	1	ns	ns	1	6
Rock Cr	1	1	1	1	1	1	1	1	1	1	1	1	1	ns	1	ns	1	15
Shady Lake	ns	1	2	2	ns	ns	ns	ns	1	2	1	1	1	1	1	1	1	15
Story Pd	ns	ns	ns	ns	1	1	1	ns	1	1	1	ns	1	1	ns	ns	1	9
Sylvia	1	1	1	1	1	1	1	ns	ns	ns	ns	ns	ns	1	1	1	1	11
Yearly totals	5	9	12	14	14	14	14	9	17	19	20	20	18	16	15	17	20	253

ns= no sample

E. Deer Survey Collection Procedures

Deer Spotlight Survey Data

Fourteen deer spotlight surveys are conducted on the Forest. These 25-mile long survey routes sample approximately 12,740 acres annually. This process is used to assess deer population levels and trends through the use of spotlight counts. These data are used to supplement deer depredation, highway mortality, harvest, biological, and observation data collected on deer. This information is also used in the development of harvest recommendations and in the evaluation of deer population models.

Spotlight count data have been collected in the Ouachita Mountains since the late 1970's. Data collected on the Forest are sent to the State wildlife agencies. Data analysis and report generation are accomplished by the use of a computer program developed by Urbston et al. (1987).

Surveys are conducted in winter (late February – early March) and are initiated five days following the full moon. This allows approximately two weeks to complete the surveys. Counts are initiated at dark (approximately one hour after sunset) and the routes are driven at speeds of 8 – 10 miles per hour. Data on the number of deer observed along each one-mile section are recorded on data forms. Routes are surveyed for a minimum of 6 nights, preferably ten. Survey routes are permanent and are surveyed annually. Following the surveys, an average route visibility distance is computed for each route. Measurements are taken on both sides of the road at 50 random points to determine sight distances.

Deer Harvest Data Collection Procedures

The deer management program is designed to allow for annual harvest through established seasons and bag limits and maintain a healthy deer herd with a balanced sex and age structure at a level that is consistent with long term habitat capability. Populations are maintained at levels that are consistent with public satisfaction and acceptance. Harvest regulations differ throughout both Arkansas and Oklahoma due to differences in the quantity and quality of range and deer populations.

Deer harvest data are collected by harvest methods including modern firearm, crossbow, archery, and muzzleloader from the different units and Wildlife Management Areas. Data on sex and age are taken at deer checkpoint stations.

F. Quail Survey Procedures

Spring Quail

Introduction: Spring call counts have been used to help determine the breeding and hunting potential of northern bobwhites. Rosene (1957) states that a change (increase or decrease) in the number of calling males is directly related to the same change (increase or decrease) in the coveys in the fall. Schwartz (1974) showed a linear relationship between call counts and the total quail harvest and average season bag. Schwartz also indicated that a roadside count (brood survey) in August is even more significant in predicting the harvest.

The key to the call count is the time of year when the routes are run. Peak calling occurs just prior to and during nesting. From the quail wings checked in past hunting seasons (aging juvenile birds to determine peak hatching dates), the last two weeks of May and/or the first two weeks of June would fit this criterion. Past quail brood surveys conducted in Arkansas by Game and Fish Commission personnel and postal mail carriers correspond with this information.

Materials and Methods: Permanent quail call count routes are established on the Forest in Arkansas and Oklahoma. All routes are surveyed between May 15 and June 15. Each 4.2-mile route consists of 15 stops with two-minute listening times. The stops are 0.3 miles apart. Surveys start at sunrise on clear, calm days with a wind speed of no more than 7 mph. Counts are made outside of and 30 feet away from the vehicle. Each of the 14 routes samples 725 acres for a total of 10,150 acres on the Forest.

Bobwhite Quail Brood Survey

Introduction: Annual quail brood surveys are conducted to obtain information on the annual production and nesting cycles of quail in Arkansas and Oklahoma. Many researchers including Stoddard (1936), Rosene (1969), Stanford (1972), and Schwartz (1974) have documented the importance and usefulness of an annual summer brood survey for monitoring quail reproduction. This survey provides answers to questions concerning the fluctuations in quail populations from one year to the next. Most importantly, an annual comparison can be made of production index computed from the average number of broods observed per observer. Also, peak hatching dates can be determined to see if one successful hatch occurred or if there were several less successful attempts. By examining the length of time between the peaks, it can be determine if failures have occurred in nesting and if there is juvenile mortality. By monitoring the average number of chicks per brood the success of reproduction can be determined. When this information is combined with spring call count data the annual population changes can be assessed. This information can be used as a basis for making management decisions.

Materials and Methods: Survey forms are distributed to Forest field personnel. Surveys are initiated on June 15 and completed on August 31. Information is collected on all broods, pairs and single birds seen during normal daily activities. Additional information is obtained on the number of juvenile birds observed in a brood if a count could be made. Each person is asked to age the young birds by using a field observation key on the back of the brood survey tally form.

During this period approximately 185,000 acres are surveyed. This information is sent to the appropriate state agency for analysis.

G. Turkey Brood, Gobbler, and Winter Flock Survey Procedures

The Annual Wild Turkey Brood Survey has been conducted since 1981. It has proven to be very valuable to turkey management. Field employees record all wild turkeys seen during normal working hours. Observations are recorded as to the number of gobblers, hens, poults, and unknowns seen. Poults are further denoted by size and relative age based on a graphic size and age chart. Data forms are provided to field personnel in late May and completed forms are submitted to the state game and fish agencies at the end of June, July, and August. During these months Forest personnel sample approximately 185,000 acres.

In Oklahoma, winter flock surveys are conducted in a similar manner. The survey period is from January 1 to February 28. Data are sent to the Oklahoma Department of Wildlife Conservation. Winter flock counts cover approximately 38,000 acres.

The purpose of these surveys is to obtain annual wild turkey production, survival, and population dynamics data which can be compared with data from previous years. These data are then used in the evaluation of population trends. Data are useful in making season and harvest recommendations and are helpful in predicting hunter success. Data may also be useful in future population and habitat modeling.

The wild turkey is relatively short-lived so annual poult production and recruitment is very important. In general, turkey populations tend to increase and expand their range following years of good production, while populations often decrease following several years of poor production. Therefore, turkey poult production and recruitment are important data when examining population dynamics.

The success of fall hunting seasons is very dependent on poult production. Hatches from the previous year influence the spring harvest. Knowledge of brood production and gobbler carryover obtained in this wildlife survey is therefore important to turkey managers. Each summer sighting records of wild turkey broods and adults are used to determine population trends. These sightings are used to estimate poult to hen ratios, trends in brood survival, peak hatching dates on turkey broods, gobbler carryover from the spring season, success of turkey reintroduction, and other parameters.

The turkey spring gobbler survey is another tool for assessing the health of the turkey population. Eight surveys on the Forest sample approximately 76,800 acres. Surveys are 15 miles long and are conducted along permanent preselected routes. Stops are located one mile apart with 15 stops per route. The listening period at each stop is five minutes. Counts begin 30 minutes before sunrise and run between middle of March until the end of April. Data are entered on prepared forms and submitted to the state game and fish Turkey Project Leader or analysis and reporting.

H. Red-cockaded Woodpecker Inventory Procedures

The red-cockaded woodpecker is intensively monitored on the Forest. All known birds are banded with the US Fish and Wildlife Service numbered bands. In addition color bands to identify individual birds and band combinations to indicate sex are also used. The nest cavities are surveyed for the number of eggs, hatchlings, sex of birds and numbers fledged. Birds are tied to clusters and morning and evening roost surveys are also conducted. Active territories, nesting attempts, estimated fledglings, number of adult birds, and augmentations are all reported to the US Fish and Wildlife Service annually.

I. North American Breeding Bird Survey Procedure

Established Breeding Bird Survey (BBS) Routes are used to gather data on birds on and within the Forest, including the pileated woodpecker, brownheaded cowbird, eastern bluebird, barred owl, red-cockaded woodpecker, and wild turkey, which are management indicator species. BBS are conducted in early to mid-June along permanent routes approved by the US Fish and Wildlife Service. The starting point is designated as stop number 1. At the proper starting time birds are counted at the marked starting point. The starting time is ½ hour before official sunrise. Stops are located at ½ mile (0.8 km) intervals and all 50 stops are made in exactly the same location from year to year. Stop descriptions are updated each year as necessary. Each route surveys 25 miles.

One and only one observer counts birds. Counting is done from outside the car but from a stationary point. Every bird seen within 1/4 mile (400 m) and every bird heard by the one observer should be counted during the 3 minutes at each stop. Do not stay less or more than 3 min. No method of coaxing birds can be used under any circumstances during the 3-minute counting periods. This means no "spishing" or tape playbacks or any other method. Birds seen between stops or before and after the three minutes or on scouting runs should not be counted, but may be noted in the margin. Such birds are of some interest, but extra time is not spent pursuing them, as it is important to finish within the time limit, which should be 4 to 5 hours. Bird activity changes drastically after this time.

Individual birds of all species seen or heard during each 3-minute period are counted. Estimates are used for flocks too large to count in the brief time they are seen. Only those birds actually seen or heard during the prescribed 3-minute stops are reported. The observer is careful not to count any individuals known or strongly suspected to have been counted at a previous stop. Any bird known to be a non-breeder (late migrant, injured bird, or summer vagrant) are included but marked on the data sheet as such. Easily identifiable subspecies of birds, such as Northern Flicker, Dark-Eyed Junco, and Yellow-rumped Warbler are identified. Species recorded that are not found on the form are added at the bottom. Any species unusual in the area, whether it appears on the form or not, is supported by including additional details of the observation. The number of vehicles and excess noise are also noted.

To be comparable, routes are run under satisfactory weather conditions with good visibility, little or no precipitation, and light winds. Occasional light drizzle or a very brief shower may not affect bird activity but surveying during fog, steady drizzle, or prolonged rain should be avoided. Forms are completed and returned by July 15.

J. Habitat Capability – CompPATS Model

The CompPATS wildlife model is simple. It is linear and assigns a coefficient for each species to each acre in the compartment according to forest type, stand age class, and the types of treatments applied. Uneven-aged stands, without true "age" are treated slightly differently.

As CompPATS assumes linearity of relationships, the wildlife model will tend to produce unusual and incorrect results when extreme situations are modeled. For example, an alternative proposes clear cutting 700 acres in a 1000 acre compartment in one entry, the model will show the capability to produce many more deer in the compartment than will actually occur. This is assuming that a certain amount of harvest benefits deer habitat by increasing forage, and that beyond a point, deer do not benefit. Deer may in fact decrease with additional cuts. The assumption involved is that alternatives will not be modeled unless they are "reasonable." Any alternative, which follows, or even approaches, Forest Standards and Guidelines meets this criterion.

The habitat capacity used in CompPATS shows values in terms of animals per ace unless noted otherwise, and treatment coefficients are additive and cumulative. Coefficients were developed for white-tailed deer, gray and fox squirrels, eastern wild turkey, bobwhite quail, pileated woodpecker, a fulvous harvest mouse. Even-aged regeneration harvests are modeled by re-setting the stand age to zero when harvest occurs. Separate tables are developed for wildlife habitat capacity for pine and hardwood stands on the Tiak Ranger District and the Main Division (rest of Forest) where they differ. The program uses separate tables for mixed pine-hardwood and hardwood-pine stands with values that are generally intermediate between those given for pine and hardwood stands. In addition to base level, coefficients are used for treatments including site preparation, thinning, wildlife stand improvement (WSI) overstory, WSI – midstory, wildlife seeding, wildlife shrub planting, prescribed burning, release, and wildlife openings. The model could also use coefficients for some cultural treatments not presented here.

The Ouachita wildlife habitat models used by CompPATS were developed by the Wildlife and Range Staff and the Forest Planning Team on the Ouachita National Forest, the Arkansas Game and Fish Commission, the Oklahoma Department of Wildlife conservation, and faculty from several universities. The following individuals wee primarily responsible for development of the models:

Deer:

David Urbston, PhD, Ouachita National Forest and Arkansas Game and Fish Commission
Donny Harris, Arkansas Game and Fish Commission
Larry D. Hedrick, Ouachita National Forest

Wild Turkey:

David Urbston, PhD, Ouachita National Forest and Arkansas Game and Fish Commission
Donny Harris, Arkansas Game and Fish Commission
Bob McAnnaly, Arkansas Game and Fish Commission

Ron Smith, Arkansas Game and Fish Commission
Jimmy Huntley, USDA Forest Service, Southern Region
Ron Masters, PhD, Oklahoma Department of Wildlife Conservation
Charles Gobar, Ouachita National Forest

Bobwhite Quail:

David Urbston, PhD, Ouachita National Forest and Arkansas Game and Fish Commission
Donny Harris, Arkansas Game and Fish Commission
Larry D. Hedrick, Ouachita National Forest

Pileated Woodpecker:

David Saugey, Ouachita National Forest
Douglas James, PhD, University of Arkansas, Fayetteville

K. Phase II Ecosystem Management Research and MIS – Synopsis

In 1993, experimental treatments in a replicated stand-level study were installed in 52 mature shortleaf pine-hardwood stands in the Ouachita and Ozark National Forests. The long-term study was established to test and evaluate a range of partial cutting methods and vegetation management treatments at an operational scale, but imposed in a scientifically rigorous manner. The thirteen treatments included both even-aged and uneven-aged reproduction cutting methods with long term retention of various densities, compositions, and structures of overstory pines and hardwoods, plus an untreated control. The treatments were imposed in a randomized block design with four replications. Four levels of vegetation management treatments (site preparation and release) are also being tested on a subset of the experimental stands. Objectives of the research are to determine the effects of various treatments on: establishment and growth of tree reproduction, other vegetation, birds, small mammals, arthropod and microbial communities, soils, water, cultural resources, scenic quality, recreational opportunities, and harvesting/management costs.

Thus far this research has yielded empirical data on the occurrence and abundance of a number of animal and plant Management Indicator Species (MIS) in treated and untreated stands. These MIS include pileated woodpecker, eastern bluebird, brown-headed cowbird, fulvous harvest mouse, dogwood, downy serviceberry, winged sumac, big bluestem, sessileflower chasmanthium, poverty oatgrass, inland sea oats, American beautyberry, Mexican plum, eastern hophornbeam, low-bush blueberry, and winter huckleberry. These numeric relationships apply to pine and pine-hardwood stands aged 0-10 years that result from application of seedtree, shelterwood or clearcut methods, pine and pine-hardwood stands greater than or equal to 51 years of age that are under modified even-aged management, and pine and pine-hardwood stands greater than or equal to 51 years of age that are under uneven-aged management. These categories comprise approximately 58% of the total Forest acreage.

When combined with archival CISC (Continuous Inventory of Stand Conditions) data for 1990, 1994, 1995, 1997, and current data, these numeric relationships can be used to estimate population and trend metrics for these MIS species for these years. It is acknowledged here that these estimates represent minimum occurrence and abundance information for these species because they also occur in those forest types (the remaining 42% of the Forest) that were not a part of the Phase II experiment. The Phase II research offers no information with which to make inferences about MIS occurrence and abundance in those forest types, age classes or treatment classes not a part of the experiment.