Palezone shiner
(Notropis albizonatus)

5-Year Review:
Summary and Evaluation

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5-YEAR REVIEW

Palezone shiner (*Notropis albizonatus*)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Region: Southeast Region, Carrie Straight (assisting on detail in the Regional Office), Kelly Bibb, (404) 679-7132

Lead Field Office: Kentucky Ecological Services Field Office, Dr. Michael A. Floyd, (502) 695-0468 x102

Cooperating Field Office:
Southeast Region: Alabama Ecological Services Field Office, Jeff Powell, (251) 441-5858

Peer Reviewers:
Dr. Sherry Harrel, Eastern Kentucky University
Dr. Matthew Thomas, Kentucky Department of Fish and Wildlife Resources
Rob Hurt, Wheeler National Wildlife Refuge
Gabriel Jenkins, Kentucky Department of Fish and Wildlife Resources

1.2 Methods Used to Complete the Review

Public notice of this five-year review was provided in the *Federal Register* on July 29, 2008 (73 FR 43947), and a 60-day comment period was opened. During this comment period, we obtained information on the status of this species from several experts; additional data were obtained from the recovery plan, peer-reviewed scientific literature, and our State partners. Once all known literature and information was collected for this species, Dr. Michael A. Floyd, lead Recovery Biologist with the Kentucky Ecological Services Field Office, completed the review. The draft document was peer-reviewed by Dr. Sherry Harrel, Department of Biological Sciences, Eastern Kentucky University, Richmond, Kentucky; Dr. Matthew Thomas, Kentucky Department of Fish and Wildlife Resources (KDFWR), Frankfort, Kentucky; Rob Hurt, Wheeler National Wildlife Refuge, Madison, Alabama; and Gabriel Jenkins, KDFWR; and peer review comments received were incorporated as appropriate (see Appendix A). During the open comment period, we received no public comments or information on this species.

1.3 Background

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

73 FR 43947 (July 29, 2008)

1.3.2 Species Status: (2013)

Stable. Within the Little South Fork Cumberland River (LSF) system, the species appears to be stable to increasing, occupying an approximate 48-kilometer (km) (30-mile [mi]) stream reach that extends from a point just downstream of the Kentucky (KY) 167 bridge crossing in Wayne County downstream to the Freedom Church Road bridge crossing at the Wayne County / McCreary County border. Within the Paint Rock River (PRR) system, the species occupies about 27 stream km (16.8 mi) but is not abundant throughout the system, suggesting a low population size.

1.3.3 Recovery Achieved: 2 (2= 26-50% recovery objectives achieved)

1.3.4 Listing history:

Final Rule
FR notice: 58 FR 25758
Date listed: April 27, 1993
Entity listed: species
Classification: endangered

1.3.5 Associated rulemakings: None

1.3.6 Review History:

Recovery Plan for the Palezone Shiner (*Notropis albizonatus*) (1997).

Recovery Data Call for the Palezone Shiner (*Notropis albizonatus*), 2004-2013, U. S. Fish and Wildlife Service, Kentucky Ecological Services Field Office, Frankfort, Kentucky.

1.3.7 Species' Recovery Priority Number at start of 5-year review:

5, indicating that the palezone shiner is taxonomically categorized as a species, has a high degree of threat, and has a low recovery potential according to 48 FR 43098, September 31, 1983 and 48 FR 519845, November 15, 1983.

1.3.8 Recovery plan:

Name of plan: Recovery Plan for the Palezone Shiner (*Notropis albizonatus*)
Date issued: July 7, 1997

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) Policy

2.1.1. Is the species under review listed as a DPS? No.

2.1.2. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy? No.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes.

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat? Yes.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? The recovery criteria do take into account applicable threats to this species.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

Downlisting Criteria. The palezone shiner will be considered for reclassification to threatened status when the likelihood of the species' becoming extinct in the foreseeable future has been eliminated by achievement of the following criteria:

1. Through protection and enhancement of the existing populations, a viable population of the palezone shiner exists in the LSF and PRR. The recovery plan defined "viable population" as a reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural habitat changes. The number of individuals needed and the amount and quality of habitat required to meet this criterion was to be determined for the species as one of the recovery tasks.

   Status. No definitive proof has been gathered to show that the Alabama and Kentucky populations are viable (as defined above); however, recent surveys demonstrate that the species is common to abundant within the LSFCR, occupying a total of 48 stream km (30 mi) (Jenkins 2007). The Kentucky Wild Rivers program (Kentucky Environment Protection Cabinet) has purchased and secured a total of 3,500 acres within the LSF system (Z. Couch, personal communication, 2013). These separate parcels contain a total of nearly three miles along the LSF mainstem, and the Wild Rivers program is currently pursuing other parcels within the basin. The species continues to persist within the upper half of the PRR basin of Alabama, occupying a total of 27 stream km (16.8 mi) (Shepard 1997; O'Neil et al. 2013). No permanent protection has been achieved within the PRR system, but recent fish passage evaluations followed by conservation agreements with several private landowners have contributed to the removal of three low-water ford structures - two on Hurricane Creek and one on Estill Fork.

A fourth barrier removal project is underway on Estill Fork (R. Hurt, personal communication, 2013).

2. Studies of the species' biological and ecological requirements have been completed, and the implementation of management strategies developed from these studies has been successful in increasing the number and range of the palezone shiner in the LSFCR and PRR.

   Status: New information has been gathered on the species' current distribution and biological requirements (Shepard 1997; Jenkins 2007; O'Neil et al. 2013), but management strategies have not been developed.

3. No foreseeable threats exist that would likely threaten the survival of a significant portion of the species' range in either the LSF or PRR.

   Status: Threats identified in the recovery plan still remain.

Delisting Criteria. The recovery plan states that it may not be possible to accomplish recovery for this species; delisting criteria are not provided. The species was historically known from only four rivers and/or streams. Two of these populations have been extirpated, and it is unlikely that the species can be successfully reintroduced into either of these streams due to poor water quality and habitat conditions at these sites. Therefore, unless other historical habitat can be located and repopulated or other existing populations are found, it will be difficult to protect and expand the existing populations to the point where recovery can be achieved.

2.3 Updated Information and Current Species Status

2.3.1 Biology and habitat:

2.3.1.1 Abundance, population trends, demographic features, or demographic trends:

Extant populations of the palezone shiner are restricted to the LSF and PRR (Warren et al. 1994; Shepard et al. 1997; Jenkins 2007; O'Neil et al. 2013). The species appears to be stable to increasing within the LSF system (Jenkins 2007), and recent information from Alabama (O'Neil et al. 2013) indicates that the species continues to occupy 27 stream km (16.8 mi) in the PRR system. The species was observed in low numbers (total of 110 individuals) within the PRR system and was not widespread throughout the system, suggesting a low population size. The species is considered to be extirpated from two historical sites - Marrowbone Creek, Cumberland County, Kentucky (Cumberland River drainage, one specimen) and Cove Creek, Campbell County, Tennessee

(Tennessee River drainage, one specimen) (Warren et al. 1994; USFWS 1997; Henry et al. 1999).

Warren et al. (1994) provided the first life history information for the species. Their collections detected three distinct size classes, suggesting a three-year lifespan. Males and females matured at about 35−40 mm standard length (SL). Tubercles appeared on males by mid-May, and peak spawning condition apparently occurred from June to early July. Females captured in mid-May through late June had extended abdomens and possessed large cream- to yellow-colored ova; ovaries were transparent by early August, and most ova were small and white to translucent. This suggested a spawning period from late-May through early July. Investigations by Henry et al. (1999) and Jenkins (2007) provided additional information on population structure and reproduction, but they did not modify or disagree with the spawning season (late May to late June) reported by Warren et al. (1994). Henry et al. (1999) detected three year classes based on length-frequency distributions and plots of weight versus length. Mean standard lengths and ranges were 30 mm (24-35 mm) for Age-0, 47 mm (43-52) for Age-I, and 59 mm (55-65 mm) for Age-II. Palezone shiners appeared to reach sexual maturity at about 35-40 mm SL, agreeing with that reported by Warren et al. (1994). Henry et al. (1999) observed gravid females for the first time in mid- to late-May, but tubercles were not observed on males at the same time. Spawning was never observed. Jenkins (2007) reported total lengths ranging from 17-77 mm, with a mean of 40.8 mm and 3 age classes.

2.3.1.2 Genetics, genetic variation, or trends in genetic variation:

No information is available on genetics or genetic variation of the palezone shiner.

2.3.1.3 Taxonomic classification or changes in nomenclature:

The palezone shiner was described in 1994 by Melvin L. Warren and Brooks M. Burr (Warren et al. 1994), but the species had been known to ichthyologists for over 20 years as an undescribed relative of the swallowtail shiner, *Notropis procne* (Warren et al. 1994). The palezone shiner was first recognized as a distinct species by Carl Hubbs (University of Michigan, Museum of Zoology), who examined a single specimen from Cove Creek, Campbell County, Tennessee. Working independently, R. E. Jenkins recognized the species as a distinct taxon after examining material collected by T. Zorach and R. F. Denoncourt in 1966 from the LSFCR. From the 1970s to early 1990s, the undescribed taxon was collected and reported by multiple investigators as the white-zone shiner, paleband shiner, and palezone shiner (Burr and Warren 1986; Etnier and Starnes 1993; Warren et al. 1994; USFWS 1997). The palezone shiner is a member of the *N. procne* species group and considered to be the sister species to a clade (evolutionary branch) composed of *N. uranoscopus* (skygazer shiner) and *N. chihuahua* (Chihuahua shiner) (Warren et al. 1994).

2.3.1.4 Spatial distribution, trends in spatial distribution, or historical range:

The historical range of the palezone shiner included four stream systems: LSF, McCreary and Wayne Counties, Kentucky; Marrowbone Creek, Cumberland County, Kentucky; Cove Creek, Campbell County, Tennessee; and PRR, Estill and Marshall Counties, Alabama (Warren et al. 1994; USFWS 1997). USFWS (1997) described these historical streams as ranging in size from large creeks (third order) to small rivers (fifth order). The Marrowbone Creek and Cove Creek records were each based on single specimens collected in the 1930s (Cove) and 1940s (Marrowbone). Multiple attempts to relocate the species in these streams have been unsuccessful (USFWS 1997; M. Thomas, personal communication, 2009), and the species is now considered extirpated from these two streams. Currently, populations of the species are restricted to only two, widely disjunct stream systems: the LSF in Kentucky and the PRR in Alabama.

In 2009, Matt Thomas, KDFWR Ichthyologist, discovered a single palezone shiner in a collection made by KDFWR on June 10, 2008 from lower Rock Creek in the South Fork Cumberland River system (M. Thomas, pers. comm., 2009). The identification of this individual was later confirmed by Dr. Larry Page (University of Florida), Dr. Brooks Burr (Southern Illinois University] and Dr. Melvin Warren (U.S. Forest Service). Despite extensive sampling in Rock Creek during the past decade, this is the only palezone shiner specimen encountered (or reported). Subsequent to this discovery, repeated searches were conducted in lower Rock Creek and South Fork Cumberland River, but these attempts failed to locate additional individuals. At present, it is uncertain if the presence of this individual in Rock Creek is the result of natural dispersal from the LSF population via the South Fork Cumberland River or an artificial introduction. The former scenario may have been facilitated by the recent return of riverine conditions in the lower South Fork Cumberland River resulting from repair work at Wolf Creek Dam that lowered water levels in Lake Cumberland.

Within the LSF, the species occurs within an approximate 48-km (30-mile) stream reach that extends from a point just downstream of the KY 167 bridge crossing in Wayne County downstream to the Freedom Church Road bridge crossing at the Wayne County / McCreary County border (Jenkins 2007; Henry et al. 1999). Based on observations by Jenkins (2007), the species' abundance and distribution appears to be at least equal to (maybe greater than) that observed in the mid-1990s (Henry et al. 1999). Jenkins (2007) surveyed 44 100-m sites (via seine hauls) that contained at least 2 riffles, 2 runs, and 2 pools. Within these reaches, he observed a total of 1,282 individuals from 30 sampling sites, and the palezone shiner was the fourth most abundant fish observed during the study. Henry et al. (1999) seined shorter reaches, limiting his survey efforts to 44 individual microhabitats (riffles, runs, or pools). Within these reaches, Henry et al. (1999) observed a total of 398 palezone shiners at 9 of 42 quantitative sites. Palezone shiners represented the thirteenth most abundant species in quantitative (seining) surveys. Henry et al. (1999) also observed 28 palezone shiners at 19 qualitatively sampled sites.

Similar to Henry et al. (1999), Jenkins (2007) found that palezone shiners continued to be most abundant in downstream reaches of Little South Fork (downstream of the confluence with Kennedy Creek); however, the species

appeared to have become more abundant in upstream reaches – upstream of Kennedy Creek (Jenkins 2007). During 2009, M. Thomas found the species to be present at one of three sites sampled upstream of Kennedy Creek (M. Thomas, pers. comm., 2009).

A length-frequency histogram prepared by Henry et al. (1999) indicated three age classes of palezone shiners. Mean standard lengths and ranges recorded by Henry et al. (1999) were 30 mm (24-35) for Age-0, 47 mm (43-52) for Age-I , and 59 mm (55-65) for Age-II . Length-frequency histograms prepared by Jenkins (2007) indicated high numbers in the Age-0 and Age-I groups, but individual age classes were not as defined (range of 19 – 75 mm). Successful recruitment was demonstrated in both studies.

The palezone shiner was discovered in the 1980s within the PRR system (Jandebeur and Chapman 1982; Feeman 1987). Jandebeur and Chapman (1982) made 47 fish collections from stations located throughout the PRR system, but the palezone shiner was limited to a short reach extending from about 1.3 miles northeast of Princeton, Alabama upstream to the town of Estill Fork, Alabama. Warren and Burr (1990) searched areas upstream and downstream of this reach and observed no palezone shiners. Shepard et al. (1997) observed the species at 12 of 28 collection sites during the summer of 1997. A total of 84 individuals were collected, with 36 of these individuals coming from a single site (County Highway 140 bridge crossing). Based on these surveys, Shepard et al. (1997) estimated that palezone shiners occupy about 27 river km (16.8 mi) in the PRR system: 8.8 km (5.5 mi) of the upper PRR (from river km 87.7 (mile 54.5) upstream to the confluence of Hurricane Creek and Estill Fork), the lower 9.3 km (5.8 mi) of Estill Fork, and the lower 2.4 km (1.5 mi) of Larkin Fork. O'Neil et al. (2013) surveyed 19 sites in the PRR system in 2010, finding palezone shiners in the same general stream reach as Shepard (1997). Results of both studies indicate a small population size within the PRR, with the species being restricted to only selected habitats in the basin (Shepard et al. 1997; O'Neil et al. 2013).

2.3.1.5 Habitat:

The palezone shiner occurs in flowing pools and runs of upland streams that have permanent flow, clear water, and substrates composed of bedrock, cobble, pebble, and gravel mixed with clean sand (USFWS 1997). In May 1990, Warren et al. (1994) collected the species in the PRR from pools (60-75 cm depth) over fine to coarse gravel mixed with sand. In June 1990, Warren et al. (1994) observed the species in shallow (30-45 cm, 1.2-1.8 in) runs and pools of the Little South Fork that were underlain by fractured bedrock and scattered gravel patches. In August 1990, they collected individuals in the Little South Fork from pools and runs with current velocities ranging from 0.6-4.5 cm/sec (0.02-0.15 feet/sec) and mean depth of 59 cm (2.3 in). Substrates varied from sand mixed with fine and coarse gravel to bedrock. Shepard et al. (1997) reported the species from pools and runs of the PRR that had substrates composed of a mixture of cobble, gravel, and sand. Water depths ranged from 30.5-76.2 cm (12-30 in).

Henry et al. (1999) observed palezone shiners at an average depth of 30 cm (range of 12 to 63 cm) and in areas with an average current velocity of 6 cm/sec (range of 0 to 24 cm/sec). Palezone shiners were observed over a variety of substrates, including mixtures of sand, gravel, and pebble, with some areas containing cobble and bedrock. Individuals were also observed near gravel bars that were bordered by beds of water willow, *Justicia americana*. Palezone shiners were most common in runs, but the upper and lower ends of pools were also preferred.

2.3.1.6 Other:

According to Henry et al. (1999), palezone shiners feed primarily (89 percent of identified remains) on fly larvae (Suborder Nematocera), but other aquatic organisms were observed in gut analyses (small crustaceans, roundworms, aquatic mites, diatoms, and some plant material). The species likely feeds throughout the day but is probably more active during daylight hours (Henry et al. 1999). Common associates of the palezone shiner include *Pimephales notatus* (bluntnose minnow), *Lythrurus fasciolaris* (scarlet shiner), *Notropis volucellus* (mimic shiner), *Nocomis effusus* (redtail chub), *Notropis telescopus* (telescope shiner), *Luxilus chrysocephalus* (striped shiner), *Percina caprodes* (logperch), and *Cyprinella galactura* (whitetail shiner) (Henry et al. 1999).

2.3.2 Five-factor analysis:

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

The primary threats listed in the palezone shiner recovery plan (USFWS 1997) were water pollution from coal mining activities, reservoir construction and subsequent loss of free-flowing stream habitat, removal of riparian vegetation and concomitant increases in stream temperatures, stream channelization, increased siltation associated with poor agricultural and mining practices, and deforestation of watersheds. All of these threats remain, but resource extraction (primarily oil production and coal mining) has been blamed most often by Kentucky investigators for the observed water quality and habitat degradation that has occurred over the past three decades in the LSFCR. Within the PRR basin, the species continues to be threatened by nonpoint source pollutants (sediment, nutrients) originating from poor agricultural and logging practices and poorly maintained, unpaved roads (USFWS 1997; Shepard et al. 1997).

<u>Little South Fork Cumberland River</u>

Oil production along the Little South Fork boomed during the early 20th century, before 1925 (Henry et al. 1999). This was followed by an expansion of coal surface mining along ridges of the lower valley from the mid-1970s to mid-1990s (Anderson et al. 1991) and an increase in oil extraction in the early to mid-1980s (Warren and Haag 2005). Oil slicks were observed as late as 1997 by Henry et al. (1999) approximately 1.4 km (2.2 mi) downstream of the KY 167 bridge crossing. Henry et al. (1999) also detected the smell of diesel fuel at one of their sampling sites (Site #29, about 2.4 km (3.9 mi) downstream of Green

Church Ford). Other investigators (Harker et al. 1980) observed an old oil pipeline near one of their sites that continued to leak oil/brine into Little South Fork, causing slicks and oil odors. As late as 1981, 4 inactive and 11 active surface mines were present in the Little South Fork basin (Starnes and Bogan 1982), and Starnes and Bogan (1982) also detected hydrogen sulfide odors in the upper half of the stream. Henry et al. (1999) did not report any active mines, but they did observe acid discharge in one tributary (Clark Hollow) of the LSFCR and high acidity (low pH readings) at two points along the stream with orange substrates (probably ferric hydroxide or "yellowboy") typical of acid mine drainage. Dissolved metals (and subsequent elevated instream conductivity) are a more serious problem that could affect longer stream reaches of the LSFCR (Anderson et al. 1991). Jenkins (2007), observed no direct, adverse effects from mining or oil exploration activities during field investigations in 2006 and 2007. More recent investigations by the Kentucky Division of Water (KDOW) suggest that legacy impacts (sedimentation/siltation) from surface and subsurface coal mining continue to degrade downstream sections (river km 0 to 7.1 (mi 4.4) of the LSFCR where palezone shiners do not occur (KDOW 2008; Randall Payne, KDOW, pers. comm., 2009). The approximate 48-km (30-mile) reach occupied by palezone shiners was fully supporting of the aquatic life use designation (KDOW 2008).

The mussel community of the Little South Fork (Anderson et al. 1991; Warren and Haag 2005) declined drastically during the 1980s as oil exploration and coal mining activities increased. Sixty-five percent (17 of 26) of the LSFCR's mussel species disappeared from the basin, including two species, *Villosa trabilis* (Cumberland bean) and *Pegias fabula* (littlewing pearlymussel), that are federally listed as endangered (Warren and Haag 2005). Declines in fish diversity have also been observed, especially for benthic species (Branson and Schuster 1982; Warren et al. 1994). It is likely that the entire aquatic community of the Little South Fork was adversely affected by these same mining activities.

As reported above, Jenkins (2007) did not observe active mining or oil exploration activities in the LSFCR basin, but he did report that cattle and off-road vehicles continue to threaten instream habitats. Cattle had free access to the channel and riparian zone at several locations, where they destroyed riparian cover, destabilized stream banks, and negatively affected water quality through defecation (manure). Off-road vehicles created unprotected road crossings that also destabilized bank habitats and contributed to sedimentation during rainfall events. Otherwise, the steep topography and remote location of the LSFCR basin gives it some protection against physical disturbance from agriculture and development (Henry et al. 1999).

The Kentucky Natural Resources and Environmental Protection Cabinet (Division of Water) identified loss of riparian habitat, surface coal mining, and legacy coal extraction as the three top pollutant sources in the upper Cumberland River basin (KDOW 2008). Active surface mining is absent from the basin, but the other two pollutant sources continue to impact habitats within the LSF basin. Sedimentation, elevated total dissolved solids, pathogens, and eutrophication (increased nutrients) are the primary pollutants (stressors) associated with these

activities. Sediment has been shown to abrade and or suffocate bottom dwelling algae and other organisms, reduce aquatic insect diversity and abundance, and, ultimately, negatively impact fish growth, survival, and reproduction (Waters 1995). Wood and Armitage (1997) identified at least five impacts of sedimentation on fish, including (1) reduction of growth rate, disease tolerance, and gill function; (2) reduction of spawning habitat and egg, larvae, and juvenile development; (3) modification of migration patterns; (4) reduction of food availability through the blockage of primary production; and (5) reduction of foraging efficiency.

Paint Rock River

Within the PRR basin, the species continues to be threatened by nonpoint source pollutants (sediment, nutrients) originating from poor agricultural and silvicutural practices and poorly maintained, unpaved roads (USFWS 1997; Shepard et al. 1997). O'Neil and Metee (1997) reported that eutrophication is a significant water quality problem in some tributaries of the PRR. The U. S. Army Corps of Engineers completed an extensive channelization project in the PRR basin in 1966, including reaches currently occupied by palezone shiners. The impacts of these activities are unknown because fish surveys were not completed prior to the disturbance (Ramsey 1986).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

The palezone shiner is not believed to be utilized for commercial, recreational, scientific, or educational purposes. When the species was described and listed in the early 1990s, it was suggested that the species' rareness would make it desirable to private and institutional collectors; however, over-collecting does not appear to have become a threat since that time.

2.3.2.3 Disease or predation:

The palezone shiner is undoubtedly consumed by predators as several potential predators (sunfishes - Family Centrarchidae) occupy the LSFCR and PRR basins; however, there is no evidence that predation is a significant threat to the species. The species has evolved with various predators over thousands of years and has continued to persist within the watershed. Disease is not known to be a threat to the species.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

The palezone shiner and its habitats are afforded some protection from water quality and habitat degradation under the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.), Kentucky's Forest Conservation Act of 1998 (KRS 149.330-355), Kentucky's Agriculture Water Quality Act of 1994 (KRS 224.71-140), and additional Kentucky laws and regulations regarding natural resources and environmental protection (KRS 146.200-360; KRS 224; 401 KAR 5:026, 5:031). The species is also afforded protection by the Endangered Species Act (Act) of 1973, as amended (87 Stat. 884, as amended: 16 U.S.C. 1531 *et seq*), which requires Federal agencies to consult with the Service when activities they fund, authorize, or carry out may affect a listed species. The Act requires Federal permits for any activity that may result in "take" of a listed species.

The palezone has been designated as an endangered species by Kentucky (KSNPC 2005). Kentucky law prohibits the collection of the species for scientific purposes without a valid state-issued collecting permit (KRS 150.183), but this regulation provides no protection to the species' habitat. Within Kentucky, persons who hold a valid fishing license (obtained from the Kentucky Department of Fish and Wildlife Resources [KDFWR]) can collect up to 500 "minnows" (all non-game fish less than 6 in long) per day as bait, but they are prohibited from using listed fish species such as the palezone shiner (KDFWR 2008; 301 KAR 1:130). We have no evidence that bait collection within the LSFCR represents a significant threat to the species. Within Alabama, the species has been listed as threatened (Ramsey, 1986) and is given protected status by the Fisheries Division of the Alabama Department of Conservation and Natural Resources. For the palezone shiner and other designated nongame wildlife species, Alabama regulations state that it is unlawful "to take, capture, kill, or attempt to take, capture or kill; possess; sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value" these species unless a person has a scientific collection permit or written permit from the Commissioner, Department of Conservation and Natural Resources (ADCNR 2013).

Despite the limited protection afforded by the laws and corresponding regulations cited above, the palezone shiner continues to be impacted by poor water quality and habitat degradation resulting from siltation and water quality degradation caused by poor land use practices, reductions in riparian cover, and by other nonpoint-source pollutants (see discussion under Factor 2.3.2.1 above). Existing regulatory mechanisms have been inadequate to protect the species and its habitat from these threats.

2.3.2.5 Other natural or manmade factors affecting its continued existence: The restricted range of this species makes its populations much more vulnerable to extirpation from toxic chemical spills, habitat modification, progressive degradation from land surface runoff (nonpoint-source pollutions), and natural catastrophic changes to their habitat (*e.g.*, flood scour, drought). Populations within the LSF and PRR are vulnerable to stochastic events; a single toxic chemical spill or an extremely dry summer could have devastating effects on population numbers in both systems and could threaten the long-term viability of the species.

The disjunct nature of Little South Fork and PRR populations prohibits the natural interchange of genetic material between these populations, and the small population size reduces the reservoir of genetic diversity within populations. This can lead to inbreeding depression and reduced fitness of individuals (Soule 1980; Hunter 2002). It is likely that some of the palezone shiner populations are below the effective population size required to maintain long-term genetic and population viability (Soule 1980; Hunter 2002). The disjunct nature of the two populations also makes the likelihood of recolonization of either population unlikely in the event of an extirpation event.

Climate change has the potential to increase the vulnerability of the palezone shiner to random detrimental events (e.g., McLaughlin *et al.* 2002; Thomas *et al.* 2004). Global climate change is expected to result in increasing frequency and duration of droughts and the strength of storms (e.g., Cook *et al.* 2004). The severe drought that affected Kentucky in 2007 and 2008 could be intensified by the effects of global climate change.

2.4 Synthesis

The palezone shiner is restricted to the LSF basin in Kentucky and the PRR basin in Alabama. The species has been extirpated from two historical sites - Marrowbone Creek, Cumberland County, Kentucky (Cumberland River drainage) and Cove Creek, Campbell County, Tennessee (Tennessee River drainage). Within the LSF, the species appears to be stable to increasing, occupying an approximate 48-km (30-mile) stream reach that extends from a point just downstream of the KY 167 bridge crossing in Wayne County downstream to the Freedom Church Road bridge crossing at the Wayne County / McCreary County border. Based on observations made in 2007, the species appears to be more abundant and distributed more widely in the Little South Fork than it was in the mid-1990s. Within the PRR, the species occupies about 27 stream km (16.8 stream mi) but is not abundant throughout the system, suggesting a low population size.

Three of the five listing factors considered by the Service pose threats to the palezone shiner: the present or threatened destruction, modification or curtailment of its habitat or range; the inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. The species' habitat and range have been severely degraded and limited by water pollution from coal mining and gas exploration activities, reservoir construction and subsequent loss of free-flowing stream habitat, removal of riparian vegetation and concomitant increases in stream temperatures, stream channelization, increased siltation associated with poor agricultural and mining practices, and deforestation of watersheds (Anderson et al. 1991; Henry et al. 1999; Warren and Haag 2005; Jenkins 2007; KDOW 2008). Current regulatory mechanisms have been inadequate to prevent these impacts. Due to the species' limited range, it is also vulnerable to stochastic events such as toxic chemical spills that could cause the extirpation of the species from portions of the LSF or PRR. The disjunct nature of the LSF and PRR populations prohibits the natural interchange of genetic material between these populations, and the small population size reduces the reservoir of genetic diversity within populations. This can lead to inbreeding depression and reduced fitness of individuals. It is possible that some of the palezone shiner populations are below the effective population size required to maintain long-term genetic and population viability.

Based on the best available scientific and commercial information regarding the species' current status and past, present, and future threats, the species continues to be impacted by poor water quality and habitat deterioration resulting from resource extraction activities, siltation caused by poor land use practices, reductions in riparian cover, and by other nonpoint-source pollutants. The palezone shiner's limited distribution also makes it vulnerable to toxic chemical spills and limits the natural genetic exchange between and within populations. Because of its restricted distribution and continued vulnerability to these threats, the species continues to meet the definition of endangered (in danger of extinction throughout all or a significant portion of its range) and should remain classified as such.

3.0 RESULTS

3.1 Recommended Classification: Endangered; no change is needed.

3.2 Recommended Recovery Priority Number: 5; no change recommended.

Recovery Priority Number of 5 indicates that the palezone shiner is taxonomically categorized as a species, has a high degree of threat, and low recovery potential. The species' endangered classification appears to be appropriate because of continued threats to its habitat and its limited range.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The following recovery actions should be made a priority over the next five years:

1) Continue to conduct fish inventories (at approximate five-year intervals) and water quality investigations of the LSF and PRR basins in order to monitor the status and distribution of the species and water quality conditions in each basin.

2) Conduct further fish inventories in Rock Creek and lower South Fork Cumberland River, McCreary County, Kentucky to determine the status of the species in these watersheds.

3) Determine habitat preferences of juvenile and larval palezone shiners. The biology of larvae is unknown, and recruitment estimates are lacking.

4) Determine the level of genetic exchange between populations and diversity within populations. Information on palezone shiner movements and genetics would provide important information on the species' long-term viability and its effective population size

5) Continue to protect, restore, and enhance habitat quality throughout the drainage. Federal, state, and private parties should continue to work cooperatively (through Farm Bill programs, Partners for Fish and Wildlife projects, Kentucky Wild Rivers Program, etc.) to restore and protect habitats for the species.

5.0 REFERENCES

Alabama Department of Conservation and Natural Resources. 2013. Nongame vertebrates protected by Alabama regulations, 220-2-.92 Nongame species regulation (http://www.outdooralabama.com/watchable-wildlife/regulations/nongame.cfm). Electronic version accessed April 24, 2013.

Anderson, R. M., J. B. Layzer, and M. E. Gordon. 1991. Recent catastrophic decline of mussels (Bivalvia: Unionidae) in the Little South Fork Cumberland River, Kentucky. Brimleyana 17:1-8.

Branson, B.A. and G.A. Schuster. 1982. The fishes of the wild river section of the Little South Fork of the Cumberland River, Kentucky. Transactions of the Kentucky Academy of Science 43: 60-70.

Burr, B.M. and M.L. Warren, Jr., 1986. A distributional atlas of Kentucky Fishes. Kentucky State Nature Preserves Commission Scientific and Technical Series. 4. 398 pp.

Cook, E.R., C.A. Woodhouse, C.M. Eakin, D.M. Meko, and D.W. Stahle. 2004. Long-term aridity changes in the western United States. Science 306:1015-1018.

Etnier, D.A. and W. C. Starnes. 1993. The Fishes of Tennessee. The University of Tennessee Press, Knoxville, TN. 681 pp.

Feeman, J. C. 1987. Results of fish surveys in the Tennessee River drainage, 1979-1981. Brimleyana 13:99-121.

Harker, D.F., Jr., S. M. Call, M. L. Warren, Jr., K. E. Camburn, and P. Wigley. 1979. Aquatic biota and water quality survey of the Appalachian Province, eastern Kentucky, volume 1. Technical Report, Kentucky Department of Natural Resources, Frankfort, Kentucky.

Harker, D. F., Jr., M. L. Warren, Jr., K. E. Camburn, S. M. Call, G. J. Fallo, and P. Wigley. 1980. Aquatic biota and water quality survey of the upper Cumberland River basin, volume 1. Technical report, Kentucky State Nature Preserves Commission, Frankfort, Kentucky.

Henry, D.B., W.J. Poly, and B. M. Burr. 1999. Habitat and life history aspects of the federally endangered palezone shiner, *Notropis albizonatus*, in the Little South Fork of the Cumberland River, Kentucky. Final Report submitted to the Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky. 65 pp.

Hunter, M. L., Jr. 2002. Fundamentals of Conservation Biology, second edition. Blackwell Science, Inc. Malden, Massachussetts. 547 pp.

Jandebeur, T. S. and M. G. Chapman. 1982. A report on the fishes of the Paint Rock River system in Alabama. Association of Southeastern Biologists Bulletin 29:66-67.

Jenkins, G. S. 2007. Population delineation of the palezone shiner (*Notropis albizonatus*) in the Little South Fork of the Cumberland River relative to habitat and species composition. Unpublished M.S. thesis, Eastern Kentucky University, Richmond, Kentucky. 28 pp.

Kentucky Department of Fish and Wildlife Resources (KDFWR). 2008. Kentucky's fishing and boating guide, March 2008 – February 2009. KDFWR, Frankfort, Kentucky. 46 pp.

Kentucky Division of Water (KDOW). 2008. Integrated report to Congress on water quality in Kentucky. Volume I, 305(b) report. Environmental and Public Protection Cabinet, Frankfort, Kentucky. 246 pp.

Kentucky State Nature Preserves Commission (KSNPC). 2005. Rare and extirpated biota of Kentucky. (pdf file available at: www.naturepreserves.ky.gov). 19 pp.

McLaughlin, J.F., J.J. Hellmann, C.L. Boggs, and P.R. Ehrlich. 2002. Climate change hastens population extinctions. Proceedings of the National Academy of Sciences of the United States of America 99(9):6070-6074.

O'Neil, P. E., T. E. Shepard, J. R. Powell, E. W. Spadgenske, A. R. Henderson, and P. L. Freeman. 2013. A survey of fishes in the Paint Rock River system. Open-File Report 1213, Geological Survey of Alabama, Tuscaloosa, Alabama. 28 p.

O'Neil, P.E. and M. F. Mettee. 1997. Water-Quality Assessment of the Paint Rock River Watershed, Alabama. Geological Survey of Alabama, Tuscaloosa, Alabama. 47 pp.

Payne, R. S. 2009. Personal communication regarding use attainment status of the Little South Fork (email correspondence). Biologist, Kentucky Division of Water, Frankfort, Kentucky.

Ramsey, J. S. 1986. Paleband shiner, *Notropis* sp. cf. *procne*, pages 6-7 *In* Mount, R. H. ed., Vertebrate animals in need of special attention. Auburn University, Alabama Agricultural Experiment Station.

Shepard, T. E., S. W. McGregor, and P. E. O'Neil. 1997. Status survey of the palezone shiner (*Notropis albizonatus*) in the Paint Rock River System. Geological Survey of Alabama, Tuscaloosa, Alabama. 14 pp.

Soule, M. E. 1980. Threshold for survival: maintaining fitness and evolutionary potential. Pages 151-169 *in*: M.E. Soule and B.A. Wilcox, eds. Conservation Biology. Sinauer Associates, Inc., Sunderland, Massachusetts

Starnes, L.B. and A. E. Bogan. 1982. Unionid Mollusca (Bivalvia) from the Little South Fork Cumberland River, with ecological and nomenclature notes. Brimleyana 8: 101-119.

Thomas, M. 2009. Personal communication regarding new distributional record from Rock Creek, McCreary County, Kentucky (email correspondence). Ichthyologist, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.

Thomas, C.D., A. Cameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F.N. Erasmus, M Ferreira de Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A.S. van Jaarsveld, G.F. Midgley, L. Miles, M.A. Ortega-Huerta, A.T. Peterson, O.L. Phillips, and S.E. Williams. 2004. Extinction risk from climate change. Nature 427:145-148.

U.S. Fish and Wildlife Service (USFWS). 1993. Endangered and threatened wildlife and plants: determination of endangered status for the duskytail darter, palezone shiner, and pygmy madtom. Federal Register. 58: 25758-25763.

U.S. Fish and Wildlife Service (USFWS). 1997. Recovery Plan for Palezone Shiner (*Notropis albizonatus*), Atlanta, Georgia. 28 pp.

U.S. Fish and Wildlife Service (USFWS). 2008. Endangered and threatened wildlife and plants: 5-year status review of 20 southeastern species. Federal Register. 73: 43947-43948.

Warren, M.L., Jr. and B. M. Burr. 1990. Status survey of the palezone shiner, *Notropis* sp., cf. *procne*, a federal candidate for listing. Report submitted to USFWS, Office of Endangered Species, Asheville, North Carolina. 25 pp.

Warren, M.L., Jr., B. M. Burr and J.M. Grady. 1994. *Notropis albizonatus*, a new cyprinid fish endemic to the Tennessee and Cumberland River drainages, with a phylogeny of the *Notropis procne* species group. Copeia 1994: 868-886.

Warren, M.L., Jr. and W. R. Haag. 2005. Spatio-temporal patterns of the decline of freshwater mussels in the Little South Fork Cumberland River, USA. Biodiversity and Conservation 14: 1383-1400

Waters, T. F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Soc. Monograph 7, Bethesda, Maryland.

Wood, P. J. and P. D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management. 21:203-217.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Palezone shiner (*Notropis albizonatus*)

Current classification: Endangered

Recommendation resulting from the 5-Year review: No change is needed.

Review conducted by: Dr. Michael A. Floyd, Kentucky Field Office, Frankfort, Kentucky

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 3/25/14

REGIONAL OFFICE APPROVAL:

for

Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 5-30-14

APPENDIX A: Summary of peer review for the 5-year review of the palezone shiner (*Notropis albizonatus*)

A. Peer Review Method: The draft document was peer-reviewed by Dr. Sherry Harrel, Eastern Kentucky University, Richmond, Kentucky; Dr. Matthew Thomas, KDFWR, Frankfort, Kentucky; Mr. Rob Hurt, Alabama Ecological Services Field Office, Daphne, Alabama; and Mr. Gabriel Jenkins, KDFWR; and comments received were incorporated as appropriate.

B. Peer Review Charge: Peer reviewers were asked to read the 5-year review and provide any comments, both editorial and content. Peer reviewers were not asked to comment on the status recommendation.

C. Summary of Peer Review Comments/Report: Dr. Harrel and Mr. Jenkins made a few editorial comments or changes and provided their general approval of the draft as written. Dr. Thomas provided several substantive comments and added some text. He added details regarding his recent discovery of a palezone specimen in a KDFWR collection from Rock Creek, South Fork Cumberland River system. He also corrected the current occupied habitat reach for the species by pointing out that individuals had not been observed at the KY 167 bridge crossing but from a point just downstream of the crossing. Mr. Hurt provided new details regarding surveys and conservation efforts in Alabama.

D. Response to Peer Review*:* Minor changes and edits recommended by the reviewers were accepted and incorporated into the five-year review. More substantive comments/edits made by Dr. Thomas and Mr. Hurt were also accepted.