

Palezone Shiner
(*Notropis albizonatus*)

5-Year Review:
Summary and Evaluation



Photo by Dr. Matthew R. Thomas
Kentucky Department of Fish and Wildlife Resources

U.S. Fish and Wildlife Service
Interior Region 1, North Atlantic-Appalachian
Kentucky Ecological Services Field Office
Frankfort, Kentucky

5-YEAR REVIEW
Palezone Shiner (*Notropis albizonatus*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: Public notice of this five-year review was provided in the *Federal Register* on June 20, 2019 (84 FR 28850), and a 60-day comment period was opened. We received one public response during the 60-day open comment period; comments received were incorporated as appropriate and are summarized in Appendix A. We also obtained information on the status of this species from the species' final listing rule (58 FR 25758); the Recovery Plan (U.S. Fish and Wildlife Service (Service) 1997, 2019); peer-reviewed scientific literature; unpublished field observations by Federal, State, and other experienced biologists; unpublished studies and survey reports; and notes and communications from other qualified individuals. Once all known literature and information was collected for this species, Dr. Michael A. Floyd, Recovery Biologist with the Kentucky Ecological Services Field Office, completed the review. The draft document was sent to affected Service field offices and four peer-reviewers for review; comments received were incorporated as appropriate and are summarized in Appendix B.

B. Reviewers

Lead Region: Atlanta Regional Office, Carrie Straight, 404/679-7226

Lead Field Office: Kentucky Ecological Services Field Office, Michael A. Floyd, 502/695-0468, x46102

Cooperating Field Office: Alabama Ecological Services Field Office, Rob Hurt, 256/353-7243, x29

Peer Reviewers:

Jacob Culp, Kentucky Division of Water (KDOW)

Dr. Bernie Kuhajda, Tennessee Aquarium Conservation Institute

Stuart McGregor, Geological Survey of Alabama

Dr. Matthew Thomas, Kentucky Department of Fish and Wildlife Resources (KDFWR)

C. Background:

1. Federal Register Notice citation announcing initiation of this review:

84 FR 28850 (June 20, 2019)

2. Species status: Stable. Within the Little South Fork Cumberland River (Little South Fork) system, the species occupies an approximate 49.0-kilometer (km) (30.4-mile (mi)) stream reach that extends from about the Kentucky (KY) 167 bridge crossing in Wayne County downstream to the Freedom Church Road bridge crossing at the Wayne County / McCreary County border. Surveys completed in 2020 provided evidence of reproduction and recruitment at two historical sites. Within the Paint

Rock River (Paint Rock) system, the species occupies about 40.5 stream km (25.2 stream mi), including portions of Larkin Fork, Estill Fork, Hurricane Creek, and the Paint Rock mainstem. The Palezone Shiner is not abundant throughout the Paint Rock system, suggesting a low population size.

3. Recovery achieved: 2 (2 = 26-50% of recovery objectives achieved)

4. Listing history

Original Listing

FR notice: 58 FR 25758

Date listed: April 27, 1993

Entity listed: Species

Classification: Endangered

5. Associated rulemakings: None.

6. Review History:

Each year, the Service reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we submitted information for the annual recovery data call that included a “Stable” status recommendation for the Palezone Shiner. We continue to show the species’ status recommendation in 5-year reviews. The last five-year review for the Palezone Shiner species was completed in 2014 (73 FR 43947). It recommended the species remain classified as endangered because of its restricted distribution and its continued vulnerability to habitat threats.

7. Species’ Recovery Priority Number at start of 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.

8. Recovery Plan

Recovery Plan Revision for the Palezone Shiner (*Notropis albizonatus*)
(September 2019)

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

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) Policy

- 1. Is the species under review listed as a DPS? No.**
- 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.**

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes.
2. **Adequacy of recovery criteria.**
 - a. **Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?** Yes.
 - b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?** Yes, the recovery criteria account for all applicable threats to the species.
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 (Service 1997):

- a. *Through protection and enhancement of the existing populations, a viable population of the Palezone Shiner exists in the Little South Fork and Paint Rock.* 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 continues to persist in both stream systems, with some evidence of reproduction and recruitment (Stallsmith 2019, Service unpublished data). Another comprehensive survey is needed in both systems to evaluate the species' viability. In the Little South Fork system, the species appears to occupy a total of 49.0 stream km (30.4 stream mi) (Jenkins 2007; Service unpublished data). A 16.7-km (10.4-mi) segment of the Little South Fork was designated as a Kentucky Wild River in 1972 (Kentucky Revised Statute (KRS) 146.241). The Kentucky Wild Rivers program (Kentucky Energy and Environment Cabinet) has purchased and secured a total of 3,327 acres within the Little South Fork system (J. Lillpop 2020, pers. comm.). These separate parcels contain a total of nearly 4.8 km (3 mi) along the Little South Fork mainstem, and the Wild Rivers program (Office of Kentucky Nature Preserves, (OKNP)) is

currently pursuing other parcels within the system. In the Paint Rock system of Alabama, the species occupies a total of 40.5 stream km (25.2 stream mi) (Shepard *et al.* 1997, O'Neil *et al.* 2013, Stallsmith 2019). The Nature Conservancy continues to complete habitat restoration projects within the Paint Rock system (approximately 40 projects since 2002), and they have acquired over 12,140 hectares (ha) (30,000 acres (ac)) of conservation properties (Northcutt 2020, pers. comm.). These properties include two preserves: Sharp Bingham Mountain (about 1,619 ha (4,000 ac)) and Whitaker (129 ha (320 ac)). The Service's Partners for Fish and Wildlife program, working with multiple partners, has completed several fish passage projects, resulting in the removal of low-water ford structures on Hurricane Fork and Estill Fork (Hurt 2020, pers. comm.). The Service, TNC, Natural Resources Conservation Service (NRCS), and other partners will soon be prioritizing and implementing streambank restoration projects in the Paint Rock system using grant funds from NRCS' Regional Conservation Partnership Program (Throneberry 2020, pers. comm.).

- b. *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 Little South Fork and Paint Rock.*

Status: 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.

- c. *No foreseeable threats exist that would likely threaten the survival of a significant portion of the species' range in either the Little South Fork or Paint Rock.*

Status: Threats identified in the recovery plan still remain.

Delisting Criteria. In addition to meeting downlisting criteria, the Palezone Shiner will be considered for delisting with achievement of the following criteria (Service 2019):

- a. *Two (2) additional populations of the Palezone Shiner are discovered or established that exhibit stable or increasing abundance trends, as evidenced by natural recruitment and the evidence of multiple age classes.*

Status: This criterion has not been met. The species' distribution is limited to two populations: Little South Fork (Kentucky) and Paint Rock (Alabama).

- b. *One (1) population (as defined in first delisting criterion) must occur in the upper Cumberland River system in Kentucky and/or Tennessee and one (1) population*

(as defined in first delisting criterion) must occur in the upper Tennessee River system in Alabama and/or Tennessee (addresses Factor E).

Status: This criterion has not been met. The species is restricted to one Cumberland River tributary (Little South Fork) and one Tennessee River tributary (Paint Rock).

- c. *Threats have been addressed and/or managed to the extent that the species will be viable into the foreseeable future (addresses Factors A and D).*

Status. Threats identified in the recovery plan still remain.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends, demographic features, or demographic trends:

Extant populations of the Palezone Shiner are restricted to the Little South Fork and Paint Rock systems in Kentucky and Alabama, respectively (see Appendix C) (Warren *et al.* 1994, Poly 1997, Shepard *et al.* 1997, Jenkins 2007, O’Neil *et al.* 2013, Stallsmith 2019). The species continues to occupy portions of the Little South Fork system, and we have recent evidence of reproduction and recruitment (Jenkins 2007; Culp 2019, pers. comm.; Service unpublished data). Alabama surveys by O’Neil *et al.* (2013) and Stallsmith (2019) indicate the species occupies about 40.5 km (25.2 mi) in the Paint Rock system. O’Neil *et al.* (2013) reported low numbers (total of 150 individuals from 25 sites) of Palezone Shiners within the Paint Rock system, and the species was not widespread throughout the system, suggesting a low population size. The species is considered to be extirpated from three historical sites - Marrowbone Creek, Cumberland County, Kentucky (Cumberland River drainage, one specimen, April 1947); Cove Creek, Campbell County, Tennessee (Tennessee River drainage, one specimen, November 1936); and the Tennessee River mainstem (Guntersville Reservoir), Jackson County, Alabama (1 specimen, June 1972 – Auburn University Museum of Natural History, #6115) (Warren *et al.* 1994; Service 1997; Henry *et al.* 1999; Boschung and Mayden 2004; Thomas 2020, pers. comm.).

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 distended 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.

b. Genetics, genetic variation, or trends in genetic variation:

No information is available on population genetics of the Palezone Shiner.

c. Taxonomic classification or changes in nomenclature:

The Palezone Shiner was described in 1994 by Melvin L. Warren, Jr. 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 Little South Fork. From the 1970s to early 1990s, the Palezone Shiner was collected and reported by multiple investigators under various common names, including White-Zone Shiner, Paleband Shiner, and Palezone Shiner (Burr and Warren 1986, Etnier and Starnes 1993, Warren *et al.* 1994, Service 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).

d. Spatial distribution, trends in spatial distribution, or historical range:

The historical range of the Palezone Shiner included five stream systems: Little South Fork, McCreary and Wayne Counties, Kentucky; Marrowbone Creek, Cumberland County, Kentucky; Cove Creek, Campbell County, Tennessee; Paint Rock, Jackson County, Alabama; and the Tennessee River mainstem, Jackson County, Alabama (Figure 1, Appendix C) (Warren *et al.* 1994; Service 1997; Boschung and Mayden 2004; Thomas 2020, pers. comm.). The recovery plan (Service 1997) described the first four historical streams as ranging in size from large creeks (third order) to small rivers (fifth order). The inclusion of Marrowbone Creek and Cove Creek in the historical range were each based on single specimens collected in 1936 (Cove Creek)

and 1947 (Marrowbone Creek), respectively. Multiple attempts to relocate the species in these streams have been unsuccessful (Service 1997; Thomas 2009, pers. comm.), and the species is now considered to be extirpated from these systems. The fifth historical site (Tennessee River mainstem (Guntersville Reservoir) in Jackson County, Alabama) is based on a single specimen collected by Tennessee Valley Authority (TVA) biologists in 1972 (Auburn University Museum of Natural History, #6115; Thomas 2020, pers. comm.). The species has not been observed in the Tennessee River mainstem since that time. Warren *et al.* (1994) and Boschung and Mayden (2004) reported the Palezone Shiner from one additional historical site in Alabama - Big Nance Creek near Courtland, Jackson County (Gilbert 1891); however, the record could not be substantiated and was not included in discussions of the species' historical range. Currently, the species is restricted to two, disjunct stream systems: Little South Fork and Paint Rock (Figure 1, Appendix C).

In 2009, Dr. Matthew Thomas, KDFWR Ichthyologist, discovered a possible Palezone Shiner in a KDFWR collection made on June 10, 2008 from lower Rock Creek in the South Fork Cumberland River system, McCreary County, Kentucky (Thomas 2013, pers. comm.). Photographs of this individual were later examined by Dr. Larry Page (University of Florida), Dr. Brooks Burr (Southern Illinois University), and Dr. Melvin Warren, Jr. (U.S. Forest Service), who generally agreed that the specimen appeared to be a Palezone Shiner but commented that the specimen was unusually deep-bodied anterior to the dorsal fin. Extensive sampling in downstream reaches of Rock and South Fork Cumberland River during the past decade have produced no additional specimens. Based on the lack of additional specimens and the unusual deep-body anterior to the dorsal fin of the single specimen, Dr. Thomas decided to treat the record as "questionable". Based on this information, Rock Creek is not considered to be part of the species' current range.

Little South Fork

Within the Little South Fork, the species occurs within an approximate 49-km (30-mi) stream reach that extends from about the KY 167 bridge crossing in Wayne County downstream to the Freedom Church Road bridge crossing at the Wayne County / McCreary County border (Figure 2, Appendix C) (Henry *et al.* 1999; Jenkins 2007). Henry *et al.* (1999) observed a total of 398 Palezone Shiners at 9 of 42 quantitative sites during surveys completed in 1998. Palezone Shiners represented the thirteenth most abundant species in quantitative (seining) surveys. Henry *et al.* (1999) also observed 28 Palezone Shiners during qualitative surveys at 19 sites. Henry *et al.* (1999) seined short reaches, limiting their quantitative survey efforts to 44 individual microhabitats (riffles, runs, or pools).

Similar to Henry *et al.* (1999), Jenkins (2007) observed greater abundances of Palezone Shiners 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). 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 reported a total of 1,275 individuals from 30 sampling sites, and the Palezone Shiner was the fourth most abundant fish observed during the study. During 2009, M. Thomas found the species to be present at one of three sites sampled upstream of Kennedy Creek (Thomas 2009, pers. comm.). In June 2016, KDOW staff used backpack electrofishing techniques to collect and photograph five Palezone Shiners at Ritner Ford, just downstream of Lick Creek in McCreary County (Culp 2019, pers. comm.). Two upstream fords, Steele Hollow and Lonesome Road, were also surveyed by KDOW biologists, but no Palezone Shiners were observed (Culp 2020, pers. comm.).

In July 2020, OKNP, KDFWR, and the Service completed fish surveys at three sites on the Little South Fork: Green Ford (Wayne County), Steele Hollow Ford (Wayne County), and Freedom Church Ford (McCreary County/Wayne County border). A total of 43 Palezone Shiners were observed during repeated, qualitative seine hauls at each site – Green Ford (4 individuals), Steele Hollow Ford (4), and Freedom Church Ford (35) (see Appendix D). Seine hauls were completed in shallow runs and slow-flowing pool habitats with bedrock, gravel, cobble, and boulder substrates.

A length-frequency histogram prepared by Henry *et al.* (1999) indicated three age classes of Palezone Shiners in the Little South Fork. Mean standard lengths and ranges recorded by Henry *et al.* (1999) were 30 mm (24-35) (12.5 in (0.9—1.3)) for Age-0, 47 mm (43-52) (12.5 in (1.7—2.0)) for Age-I, and 59 mm (55-65) (2.3 in (2.2—2.3)) 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 (0.7-3.3 in)). Successful recruitment was demonstrated in both studies. Surveys completed in 2020 by OKNP, KDFWR, and the Service detected at least two age classes of Palezone Shiners from three survey reaches (see Appendix D).

Paint Rock

The Palezone Shiner was discovered in the Paint Rock system during the 1980s (Jandebeur and Chapman 1982; Feeman 1987). Jandebeur and Chapman (1982) made 47 fish collections from stations located throughout the Paint Rock system; Palezone Shiners were limited to a short reach extending from about 1.3 mi 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 observed, 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 Paint Rock system: 8.8 km (5.5 mi) of the upper Paint Rock (from river km 87.7 (mi 54.5) upstream to the confluence of Hurricane Creek and Estill Fork), the downstream 6.4 km (4 mi) of Hurricane Creek, the downstream 9.3 km (5.8 mi) of Estill Fork, and the downstream 2.4 km (1.5 mi) of Larkin Fork (Figure 3). O’Neil *et al.* (2013) surveyed 19 sites in the Paint Rock

system in 2010, finding Palezone Shiners in the same general stream reaches as Shepard *et al.* (1997).

Recent surveys by Stallsmith (2019) expanded the species' known range within the Paint Rock mainstem and Hurricane Creek. Stallsmith observed 16 Palezone Shiners in the Paint Rock mainstem south of Princeton, extending the species' downstream range by about 4.7 km (2.9 mi). Stallsmith also observed one Palezone Shiner in Hurricane Creek off County Road 9 and just south of the Walls of Jericho property. This observation extended the species' upstream range in Hurricane Creek by about 4.4 km (2.6 mi). Results of all studies indicate a small population size within the Paint Rock, with the species being restricted to only selected habitats (Shepard *et al.* 1997, O'Neil *et al.* 2013, TVA unpublished data).

e. Habitat:

The Palezone Shiner is typically observed 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 (Service 1997, Poly 1997). In the Paint Rock system, Warren *et al.* (1994) collected the species in pools (60-75 cm (2.4-2.9 in) depths) over fine to coarse gravel mixed with sand. In the Little South Fork system, Warren *et al.* (1994) observed the species in shallow (30-45 cm, 1.2-1.8 in) runs and pools that were underlain by fractured bedrock and scattered gravel patches. In August 1990, Warren *et al.* (1994) 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 Paint Rock that had substrates composed of a mixture of cobble, gravel, and sand. Water depths ranged from 30.5-76.2 cm (12-30 in).

In the Little South Fork, 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 species was also observed in the upper and lower ends of pools.

f. 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). Feeding activity

involves picking at sand and gravel substrates or tufts of filamentous algae growing on gravel, pebble, or bedrock substrates (Poly 1997). Common associates of the Palezone Shiner in the Little South Fork 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. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

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

The primary habitat threats listed in the Palezone Shiner recovery plan (Service 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. Resource extraction (primarily oil production and coal mining) has been implicated most often by Kentucky investigators for the observed water quality and habitat degradation that has occurred over the past four decades in the Little South Fork; however, threats associated with surface coal mining have decreased in magnitude since activities ceased in the late 1980s. Within the Little South Fork system, the species continues to be threatened by nonpoint source pollutants and habitat disturbance associated with oil and gas production (wells), legacy coal mining, agriculture, and off-road vehicle use (Warren and Haag 2005, Jenkins 2007). Within the Paint Rock system, the species continues to be threatened by nonpoint source pollutants (sediment, nutrients) originating from poor agricultural and logging practices and poorly maintained, unpaved roads (Service 1997; Shepard *et al.* 1997; Fobian *et al.* 2014).

Little South Fork

Oil production along the Little South Fork boomed during the early 20th century prior to 1925 (Henry *et al.* 1999). This was followed by an expansion of surface coal 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). Harker *et al.* (1980) discovered an old oil pipeline near one of their sites that was leaking oil/brine into the Little South Fork, causing slicks and oil odors. Oil slicks and petroleum coatings along the stream bottom and high levels of chlorides (indicative of brine wastes) were reported by multiple investigators in the late 1970s and 1980s (Harker *et al.* 1980, Layzer and Anderson 1992, and Warren and Haag 2005). Sediment samples taken in 1987 from multiple sites along the Little South Fork contained hydrocarbon contaminants characteristic of streams affected by crude or refined petroleum (Robison 1996). 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). Warren and Haag (2005) concluded that chronic exposure to an unidentified ground or surface water stressor associated with oil production activities was the primary cause of mussel declines in the upstream half of the Little South Fork system in the late 1980s. Oil and gas production continues to occur within the system, especially in the upstream half of the watershed in Wayne County. Our search of the Kentucky Geological Survey's Map Information Service revealed a current total of over 500 oil and gas wells in the Little South Fork system (KGS 2020). A variety of chemicals (e.g., hydrochloric acid, surfactants, potassium chloride) are used during the drilling process (Colborn *et al.* 2011) and can be harmful to aquatic organisms, including at-risk fishes, if they leave the drill site and enter nearby waterways (Papoulias and Velasco 2013).

As late as 1981, Starnes and Bogan (1982) identified 4 inactive and 11 active surface mines in the Little South Fork system, and they also detected hydrogen sulfide odors in the upper half of the stream. Anderson *et al.* (1991) reported an increase in surface coal mining in downstream portions of the Little South Fork system during the early 1980s and suspected that this increased activity and associated pollutants had contributed to drastic declines in the mussel fauna. Henry *et al.* (1999) did not report active mines, but they did observe an acid discharge in one tributary (Clark Hollow) of the Little South Fork 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. Jenkins (2007) observed no direct, adverse effects from surface coal mining during field investigations in 2006 and 2007; however, increased acidity (low pH) and elevated conductivity could be harmful to the Palezone Shiner; these pollutants have contributed to declines in abundance over time for other at-risk fishes, such as Blackside Dace (*Chrosomus cumberlandensis*) and Kentucky Arrow Darter (*Etheostoma sagitta spilotum*) (Black *et al.* 2013, Hitt *et al.* 2016). Mining data supplied by the Kentucky Department of Natural Resources indicated that the last active surface mine in the Little South Fork system was closed in May 1987 (Barbour 2020, pers. comm.), but recent KDOW investigations suggest that legacy effects (e.g., acid mine drainage, elevated conductivity, sedimentation) from surface and subsurface coal mining continue to degrade downstream sections (river km 0 to 7.1 (river mi 0 - 4.4) of the Little South Fork (KDOW 2013, 2018).

The mussel community of the Little South Fork declined drastically during the 1970s and 1980s as oil exploration and coal mining activities increased (Anderson *et al.* 1991; Warren and Haag 2005). Sixty-five percent (17 of 26) of the Little South Fork's mussel species disappeared from the system, 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

(e.g., macroinvertebrates, fishes, mussels) of the Little South Fork was adversely affected by these same mining activities. Precise stressors were not identified, but high metal concentrations in sediments, iron precipitates (“yellow boy”) to nearly a meter in depth, and low pH (<4) were reported from the system (Anderson *et al.* 1991, Layzer and Anderson 1992, Henry *et al.* 1999, Warren and Haag 2005), all of which strongly implicate surface coal mining runoff as the cause of water quality degradation and subsequent mussel declines.

The Little South Fork system’s steep topography and remote location gives it some protection against physical disturbance from development (Henry *et al.* 1999), but poor land use practices associated with agriculture and off-road vehicle use continue to impact habitats within the system. Jenkins (2007) reported cattle in the channel and riparian zone of the Little South Fork at several locations, where they had destroyed riparian cover, destabilized stream banks, and negatively affected water quality through inputs of animal waste and sediment. Jenkins (2007) also reported disturbance of the Little South Fork and its tributaries by off-road vehicle use. These activities destroy instream habitats and create unprotected road crossings that contribute to sedimentation during high flow events. Sediment is one of the primary stressors of aquatic habitats in the upper Cumberland River drainage, including the Little South Fork system (KDOW 2013, 2018). 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

Within the Paint Rock system, the species continues to be threatened by nonpoint source pollutants (sediment, nutrients) originating from poor agricultural and silvicultural practices; small impoundments; residential development; and poorly maintained, unpaved roads (Service 1997; Shepard *et al.* 1997; Fobian *et al.* 2014). O’Neil and Mettee (1997) reported that eutrophication is a significant water quality problem in some Paint Rock tributaries. In the 1960s, the U. S. Army Corps of Engineers completed an extensive channelization project in the upper Paint Rock system, including Larkin and Estill forks and Hurricane Creek (Ahlstedt 1995; Fobian *et al.* 2014). The impacts of these activities are unknown because fish surveys were not completed prior to the disturbance (Ramsey 1986); however, we suspect that sedimentation associated with these activities was severe and it degraded instream habitats used by the Palezone Shiner. The Alabama Department of Environmental Management (ADEM 2020) identified three impaired reaches within the Paint Rock system: Clear Creek (from source downstream to Paint Rock River confluence (10.3 km or 6.4 mi)), Cole Spring

Branch (from source downstream to Paint Rock River confluence (9.8 km or 6.1 mi)), and the mainstem Paint Rock (from source downstream to Cole Spring Branch confluence (45.8 km or 27.1 mi)). For all three streams, the cause of the impairment was listed as pathogens (*E. coli*) associated with pasture grazing (ADEM 2020). Elevated inputs of animal waste could reduce stream oxygen levels and lead to nuisance algal growths. Reduced oxygen levels could lead to fish kills, while dense growths of algae could interfere with feeding and reproduction of fishes.

b. 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.

c. Disease or predation:

The Palezone Shiner is undoubtedly consumed by predators as several potential predators (sunfishes - Family Centrarchidae) occupy the Little South Fork and Paint Rock systems; 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 these watersheds. Disease is not known to be a threat to the species.

d. 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), Kentucky Wild Rivers Act (KRS 146.241), and additional Alabama and Kentucky laws and regulations regarding natural resources and environmental protection (Alabama Administrative Code, Title 22, Section 22-22-1 *et seq.*; 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 Shiner has been designated as an endangered species in Kentucky (OKNP) 2019) and is listed a species of greatest conservation need in Kentucky's Wildlife Action Plan (KDFWR 2013). 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 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 2019; 301 KAR 1:130). We have no evidence that bait collection within the Little South Fork represents a significant threat to the species.

Within Alabama, the species is recognized as a species of greatest conservation need (Priority 1 or highest conservation concern) in Alabama's Wildlife Action Plan (Alabama Department of Conservation and Natural Resources (ADCNR) 2015). The species is also given protected status by the Fisheries Division of ADCNR (Alabama Code 22-2-.92). 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 2020).

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 in Section 2.a). Existing regulatory mechanisms have been inadequate to protect the species and its habitat from these threats.

e. Other natural or manmade factors affecting its continued existence:

The Palezone Shiner has a limited geographic range, consisting of approximately 89.5 stream km (55.6 stream mi). The two existing populations are localized, and geographically isolated from one another due to impoundments and long stream distances, leaving them vulnerable to extirpation from intentional or accidental toxic chemical spills, habitat modification, progressive degradation from runoff (non-point source pollutants), natural catastrophic changes to their habitat (e.g., flood scour, drought), other stochastic disturbances, and decreased fitness from reduced genetic diversity. A single chemical spill or major stochastic event (e.g., drought) along the mainstem of either the Little South Fork or Paint Rock could be catastrophic for the species and affect a significant portion of either population. Potential sources of unintentional spills include accidents involving trains or motor vehicles transporting chemicals over railroad or road crossings of streams inhabited by the Palezone Shiner, or the accidental or intentional release of chemicals used in oil and gas exploration, agriculture, or residential applications into streams. The unnatural level of isolation of the Palezone Shiner makes

repopulation following localized extirpations virtually impossible without human intervention.

Species that are restricted in range and population size are more likely to suffer loss of genetic diversity due to genetic drift, potentially increasing their susceptibility to inbreeding depression, decreasing their ability to adapt to environmental changes, and reducing the fitness of individuals (Soulé 1980, pp. 157–158; Hunter 2002, pp. 97–101; Allendorf and Luikart 2007, pp. 117–146). Some small Palezone Shiner populations may be below the effective population size required to maintain long-term genetic and population viability (Soulé 1980, pp. 162–164; Hunter 2002, pp. 105–107). The long-term viability of a species depends on the conservation of numerous local populations throughout its geographic range (Harris 1984, pp. 93–104). These separate populations are essential for the species to recover and adapt to environmental change (Harris 1984, pp. 93–104; Noss and Cooperrider 1994, pp. 264–297).

D. Synthesis

The Palezone Shiner is restricted to the Little South Fork system in Kentucky and the Paint Rock River system in Alabama (Figure 1, Appendix C). The species has been extirpated from Marrowbone Creek, Cumberland County, Kentucky (Cumberland River drainage); Cove Creek, Campbell County, Tennessee (Tennessee River drainage); and the Tennessee River mainstem (Guntersville Reservoir), Jackson County, Alabama (Figure 1, Appendix C). Within the Little South Fork, the species occupies a 49.0-km (30.4-mi) stream reach that extends from about the KY 167 bridge crossing in Wayne County downstream to the Freedom Church Road crossing (Freedom Church Ford) at the Wayne County / McCreary County border. Collections in July 2020 documented the species' continued presence at three historical sites (Appendix C), with evidence of reproduction and recruitment. The species occupies about 40.5 km (25.2 mi) in the Paint Rock system, but recent surveys suggest a small population size (Shepard *et al.* 1997, O'Neil *et al.* 2013, TVA unpublished data). Stallsmith (2019, pers. comm.) completed surveys from August to October 2018 at six sites in the Paint Rock system, expanding the species' known range by 4.7 km (2.9 mi) in the Paint Rock mainstem (downstream) and by 4.4 km (2.6 mi) in Hurricane Creek (upstream).

The Palezone Shiner continues to be threatened by three of the Service's five listing factors: 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 historical 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. Current regulatory mechanisms have been inadequate to prevent these threats, and past threats are still present and influencing the species' survival and reproduction. 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 significant portions of the Little South Fork or Paint Rock systems. The linear nature of occupied reaches on the Little South Fork and Paint Rock increases their vulnerability to a chemical spill, and the hundreds of oil and gas wells in the upper portions of the Little South Fork system represent an abundant source of these pollutants. The disjunct nature of the Little South Fork and Paint Rock 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 available to the Service 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 and channelization, siltation caused by poor land use practices, reductions in riparian cover, and by other nonpoint-source pollutants. The limited distribution of these populations also makes them vulnerable to toxic chemical spills and limits the natural genetic exchange between and within populations. Because of their restricted distribution and continued vulnerability to habitat threats, we believe that the Palezone Shiner continues to meet the definition of an endangered species under the Act.

III. RESULTS

A. Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

IV. 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 Little South Fork and Paint Rock systems in order to monitor the status and distribution of the species and water quality conditions in each system.
- 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 the larval stage is unknown, and recruitment estimates are lacking.

- 4) Consult with agency partners and species experts to determine what biological or ecological studies are needed to better understand the species' life history and sensitivity to threats. Using this information, determine what management strategies are needed to improve the species' status in the Little South Fork and Paint Rock systems.
- 5) Determine the level of genetic exchange (if any) between populations and diversity within populations (population genetics). Information on Palezone Shiner movements and genetics would provide important information on the species' long-term viability and its effective population size.
- 6) Continue to protect, restore, and enhance habitat quality throughout the Little South Fork and Paint Rock systems. 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.
- 7) Organize and assemble a group of agency partners and other species experts to evaluate the possibility of reintroducing the species into other Cumberland and Tennessee River tributaries.

V. REFERENCES

- Ahlstedt, S.A. 1995. Status survey for federally listed endangered freshwater mussel species in the Paint Rock River system, Northeastern Alabama, USA. *Walkerana* 8:63–80.
- Alabama Department of Conservation and Natural Resources (ADCNR). 2015. Alabama's wildlife action plan, 2015-2025. Division of Wildlife and Freshwater Fisheries, Montgomery, Alabama.
- Alabama Department of Conservation and Natural Resources (ADCNR). 2020. Nongame vertebrates protected by Alabama regulations, 220-2-.92 Nongame species regulation (<https://www.outdooralabama.com/hunting-wildlife-regulations/nongame-fishes-protected-alabama-regulations>). Electronic version accessed July 23, 2020.
- Alabama Department of Environmental Management (ADEM). 2020. 2020 integrated water quality monitoring and assessment report, water quality in Alabama, 2018-2020. Water Division, Water Quality Branch, Montgomery, Alabama. 118 pp. + appendices.
- Allendorf, F.W. and G. Luikart. 2007. Conservation and the genetics of populations. Malden, Massachusetts, Blackwell Publishing. 642 pp.
- 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.

- Barbour, T. 2020. Personal communication (email correspondence) regarding coal mining activity in the Little South Fork system, McCreary and Wayne counties, Kentucky. Kentucky Division of Natural Resources, Frankfort, Kentucky.
- Black, T.R., B.K. Jones, and H.T. Mattingly. 2013. Development and validation of habitat models for the threatened blackside dace, *Chrosomus cumberlandensis*, at two spatial scales. *Southeastern Naturalist* 12:27-48.
- 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.
- Boschung, H.T. and R.L. Mayden. 2004. *Fishes of Alabama*. Smithsonian Books, Washington, D.C. 960 pp.
- 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.
- Culp, J. 2019. Personal communication (email correspondence) regarding KDOW Palezone Shiner surveys in the Little South Fork system, Kentucky. Kentucky Division of Water, Frankfort, Kentucky.
- Culp, J. 2020. Personal communication (email correspondence) regarding KDOW Palezone Shiner surveys in the Little South Fork system, Kentucky. Kentucky Division of Water, Frankfort, Kentucky.
- 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.
- Fobian, T.B., M.L. Buntin, J.T. Holifield, T.A. Tarpley, J.T. Garner, and P.D. Johnson. 2014. Freshwater mussels (Unionidae) in the Paint Rock River (Jackson, Madison, and Marshall Counties), Alabama. *Southeastern Naturalist* 13:347-366.
- Gilbert, C.H. 1891. Report of explorations made in Alabama during 1889, with notes on the fishes of the Tennessee, Alabama, and Escambia Rivers. *Bull. U.S. Fish Comm.* 9:143-159.
- 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.
- Harris, L.D. 1984. *The Fragmented Forest*. University of Chicago Press, Chicago, Illinois. 211 pp.

- 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.
- Hitt, N.P. M. Floyd, M. Compton, and K. McDonald. 2016. Threshold responses of Blackside Dace (*Chrosomus cumberlandensis*) and Kentucky Arrow Darter (*Etheostoma spilotum*) to stream conductivity. *Southeastern Naturalist* 15:41-60.
- Hunter, M.L., Jr. 2002. *Fundamentals of Conservation Biology*, second edition. Blackwell Science, Inc. Malden, Massachusetts. 547 pp.
- Hurt, R. Personal communication (email correspondence) regarding U.S. Fish and Wildlife Service restoration activities in the Paint Rock River system, Alabama. Alabama Ecological Services Field Office, Daphne, Alabama.
- 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, R.E. 1976. A list of undescribed freshwater fish species of continental United States and Canada, with additions to the 1970 checklist. *Copeia* 1976:642-644.
- 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). 2013. Kentucky's Comprehensive Wildlife Conservation Strategy. KDFWR, Frankfort, Kentucky. Available from: <http://fw.ky.gov/WAP/Pages/Default.aspx> (Date updated 2/5/2013).
- Kentucky Department of Fish and Wildlife Resources (KDFWR). 2019. Kentucky's fishing and boating guide, March 2019 – February 2020. KDFWR, Frankfort, Kentucky. 46 pp.
- Kentucky Division of Water (KDOW). 2013. Integrated report to Congress on the condition of water resources in Kentucky, 2012. Volume I, 305(b) Assessment results with emphasis on the Salt River – Licking River basin management unit and the upper Cumberland River -4-Rivers basin management unit. Kentucky Energy and Environment Cabinet, Department for Environmental Protection, Frankfort, Kentucky. 372 pp.
- Kentucky Division of Water (KDOW). 2018. Integrated report to Congress on the condition of water resources in Kentucky, 2016. Assessment results with emphasis on the Big Sandy, Little Sandy, Tygarts River, and Kentucky River basin management units and a statewide update. Kentucky Energy and Environment Cabinet, Department for Environmental Protection, Frankfort, Kentucky. 156 pp.

- Kentucky Geological Survey (KGS). 2020. Oil and Gas Wells Search, Kentucky Geological Survey Map Information Service (<https://kgs.uky.edu/kygeode/services/oilgas/>). The University of Kentucky, Lexington, Kentucky. (Accessed 09/29/2020).
- Kentucky State Nature Preserves Commission (KSNPC). 2005. Rare and extirpated biota of Kentucky. (pdf file available at: www.naturepreserves.ky.gov). 19 pp.
- Layzer, J.B. and R.M. Anderson. 1992. Impacts of the coal industry on rare and endangered aquatic organisms of the upper Cumberland River basin. Final report to the Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky and Tennessee Wildlife Resources Agency, Nashville, Tennessee. Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, Cookeville, Tennessee.
- Lillpop, J. 2020. Personal communication (email correspondence) regarding land purchases by the Kentucky Wild Rivers Program in the Little South Fork system. Kentucky Energy and Environment Cabinet, Office of Kentucky Nature Preserves, Frankfort, Kentucky.
- Northcutt, S. 2020. Personal communication (email correspondence) regarding The Nature Conservancy properties and conservation efforts in the Paint Rock River system, Alabama. The Nature Conservancy, Birmingham, Alabama.
- Noss, R.E. and A.Y. Cooperrider. 1994. Saving Nature's Legacy. Protecting and Restoring Biodiversity. Island Press. CA. 416 pp.
- Office of Kentucky Nature Preserves (OKNP). 2019. Endangered, threatened, and special concern plants, animals, and natural communities of Kentucky. Kentucky Energy and Environment Cabinet, Frankfort, Kentucky. 20 pp. (PDF available at [https://eec.ky.gov/Nature Preserves/biodiversity/Documents/Rare_species_of_Kentucky.pdf](https://eec.ky.gov/Nature%20Preserves/biodiversity/Documents/Rare_species_of_Kentucky.pdf)).
- 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.
- 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.
- Papoulias, D.M. and A.L. Velasco. 2013. Histopathological analysis of fish from Acorn Fork Creek, Kentucky, exposed to hydraulic fracturing fluid releases. *Southeastern Naturalist* 12:92-111.
- Poly, W.J. 1997. Habitat, diet, and population structure of the federally endangered Palezone Shiner, *Notropis albizonatus* Warren and Burr, in Little South Fork (Cumberland River), Kentucky. Unpublished Master's Thesis, Southern Illinois University, Carbondale, Illinois.

- 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.
- Robison W.A. 1996. Impacts of coal mining-related contaminants on freshwater mussels: Little South Fork Cumberland River. Special Report, Project No. 88-4-046, U.S. Fish and Wildlife Service, Southeast Region, Ecological Field Services Office, Cookeville, Tennessee.
- 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.
- Stallsmith, B. 2019. Annual (2018) permit report for Federal Permit #TE28975C-0. University of Alabama – Huntsville. Huntsville, Alabama.
- 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 (email correspondence) regarding surveys for the Palezone Shiner in Marrowbone Creek, Cumberland County, and Little South Fork, McCreary County, Kentucky. Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.
- Thomas, M. 2013. Personal communication regarding a new distributional record of the Palezone Shiner from Rock Creek, McCreary County, Kentucky (email correspondence). Ichthyologist, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.
- Thomas, M. 2020. Personal communication regarding a new historical record of the Palezone Shiner from the Tennessee River mainstem, Jackson County, Alabama (email correspondence). Ichthyologist, Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky.
- Throneberry, J. 2020. Personal communication (email correspondence) regarding conservation actions under the Conservation Partnership Program in the Paint Rock River system, Alabama. Natural Resources Conservation Service, Birmingham, Alabama.
- U.S. Fish and Wildlife Service (Service). 1997. Recovery plan for the palezone shiner (*Notropis albizonatus*). Atlanta, Georgia. 28 pp.

- U.S. Fish and Wildlife Service (Service). 2019. Recovery plan revision for the palezone shiner (*Notropis albizonatus*). Atlanta, Georgia. 7 pp.
- 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 U.S. Fish and Wildlife Service, Office of Endangered Species, Asheville, North Carolina. 25 pp.
- 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.
- 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.
- 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:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Review Conducted By: Dr. Michael A. Floyd, Kentucky Ecological Services Field Office.

FIELD OFFICE APPROVAL*:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve: _____ Date: October 20, 2020

*Since 2014, Field Supervisors in Legacy Region 4 have been delegated authority to approve 5-year reviews that do not recommend a status change.

Appendix A. Summary of comments received during the 60-day open comment period.

We received a single public response during the 60-day open comment period (84 FR 28850). The National Council for Air and Stream Improvement, Inc. (NCASI) provided information regarding the use and effectiveness of silvicultural best management practices (BMPs) in the United States. NCASI explained that BMPs are implemented at high rates in the range of species such as the Palezone Shiner, and these BMPs are effective at protecting water quality, instream habitats, and aquatic biota. The commenter supported these assertions by briefly summarizing the results of 45 references summarizing the use and effectiveness of BMPs in protecting aquatic species. The commenter asked that the Service consider these references when completing its status review for the Palezone Shiner. The commenter provided no specific information related to silvicultural BMPs and the Palezone Shiner, but we agree with the commenter that BMP implementation rates are relatively high for commercial timber-harvest operations across the southeast, including forested watersheds in Kentucky, and properly implemented BMPs are effective in protecting water quality and instream habitats.

Appendix B. 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 Jacob Culp (KDOW), Dr. Bernard Kuhajda (Tennessee Aquarium Conservation Institute), Stuart McGregor (Geological Survey of Alabama), and Dr. Matthew Thomas (KDFWR). Coordination and solicitation of peer review was conducted by Dr. Carrie Straight, Atlanta Regional Office. Peer review comments were incorporated into the document as appropriate.
- B. Peer Review Charge:** Peer reviewers were asked to read the 5-year review and provide any comments, both editorial and content-related. Peer reviewers were not asked to provide recommendations on the classification of the species.
- C. Summary of Peer Review Comments:** The peer reviewers considered the revised 5-year review to be biologically sound and agreed with the species' status information and proposed conservation actions. They agreed that the review was based on the best available scientific information. Most comments were editorial in nature, with very minor substantive comments. Substantive comments included (1) a recommendation that we consider additional distributional records for the species from Big Nance Creek (Alabama) and the Tennessee River mainstem near the Alabama/Tennessee border (Warren *et al.* 1994, Boschung and Mayden 2004); (2) a clarification regarding the lack of active surface coal mining in the Little South Fork system but continued threats (sedimentation, water quality degradation) associated with these activities; (3) a recommendation that we summarize KDOW survey efforts conducted in 2016 at Ritner Ford, Steele Hollow Ford, and Lonesome Road Ford; (4) a recommendation that we include a new reference (Poly 1997) – a study of the Palezone Shiner's habitat, diet, and population structure in the Little South Fork.
- D. Response to Peer Review:** General edits and minor substantive changes were added to the review as appropriate. More substantive comments summarized above were addressed as follows: (1) the historical records from Alabama (Big Nance Creek and Tennessee River mainstem) were reviewed and the species' historical range was adjusted to include the Tennessee River mainstem in Jackson County, Alabama (the Big Nance Creek record could not be substantiated); (2) new text was added clarifying legacy effects associated with surface coal mining; (3) KDOW surveys completed in 2016 were summarized in the review; and (4) Poly (1997) was cited in the review and added to the list of references.

Appendix C – Figures

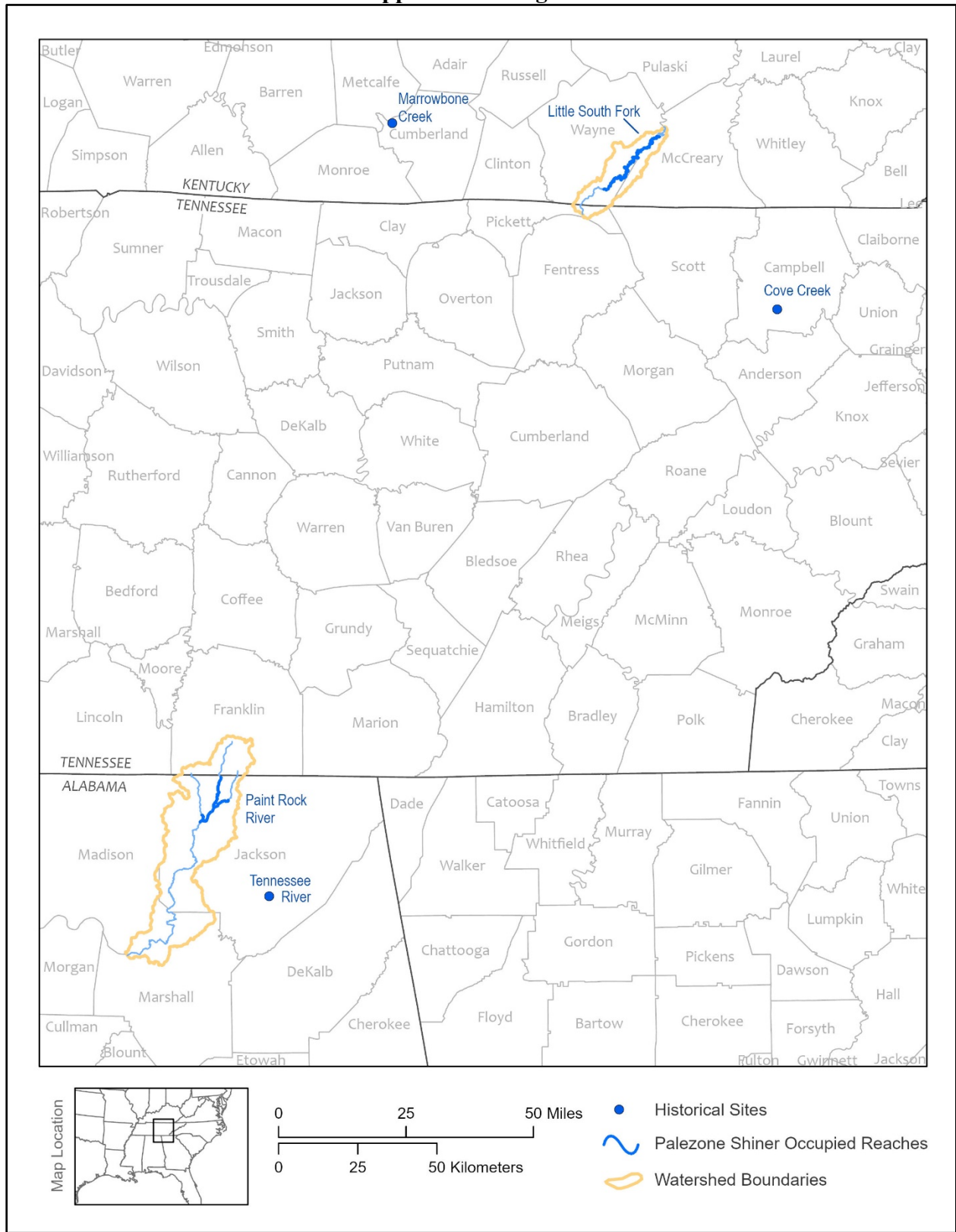


Figure 1. Palezone Shiner historical and current range.

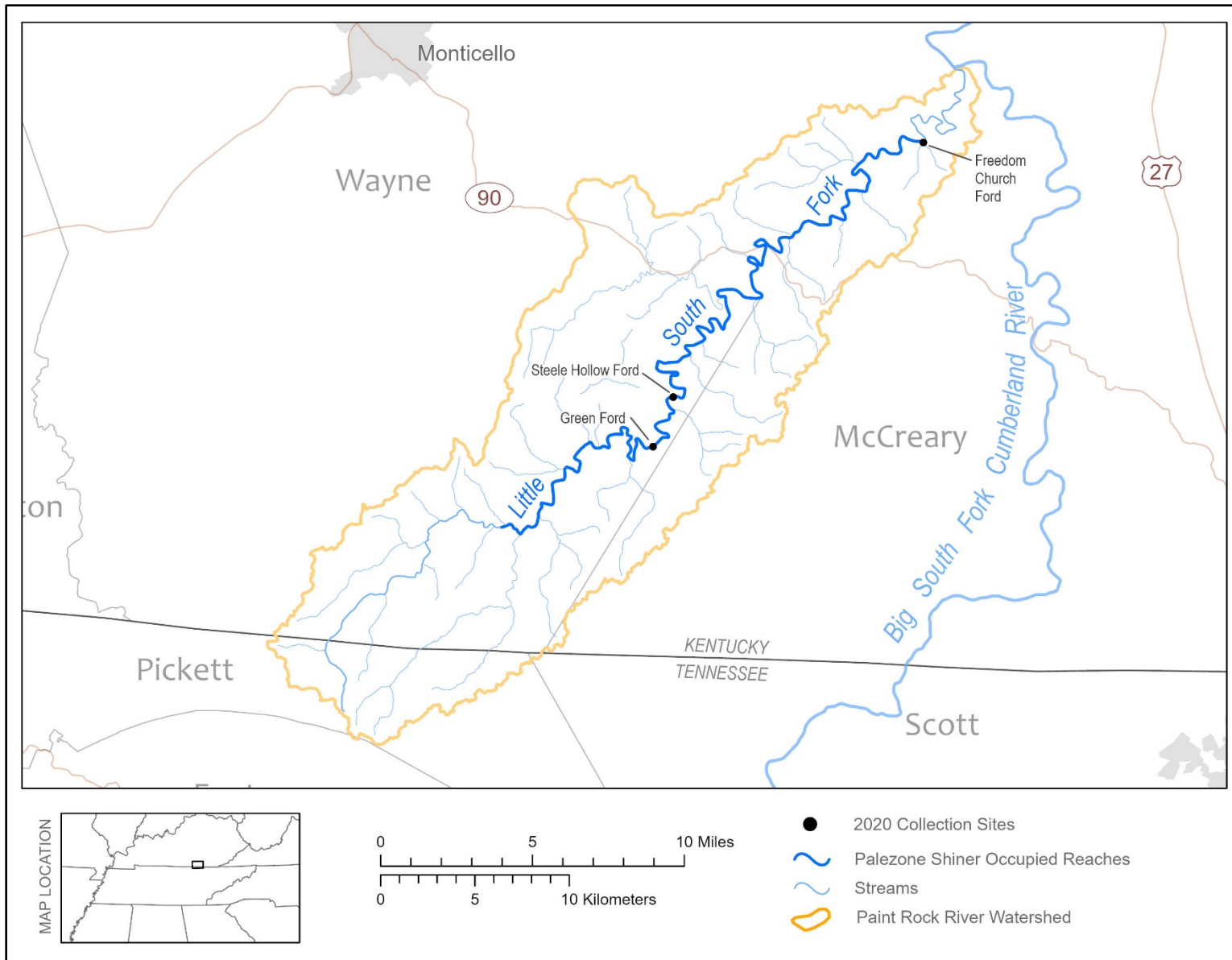


Figure 2. Palezone Shiner distribution in the Little South Fork system, McCreary and Wayne counties, Kentucky.

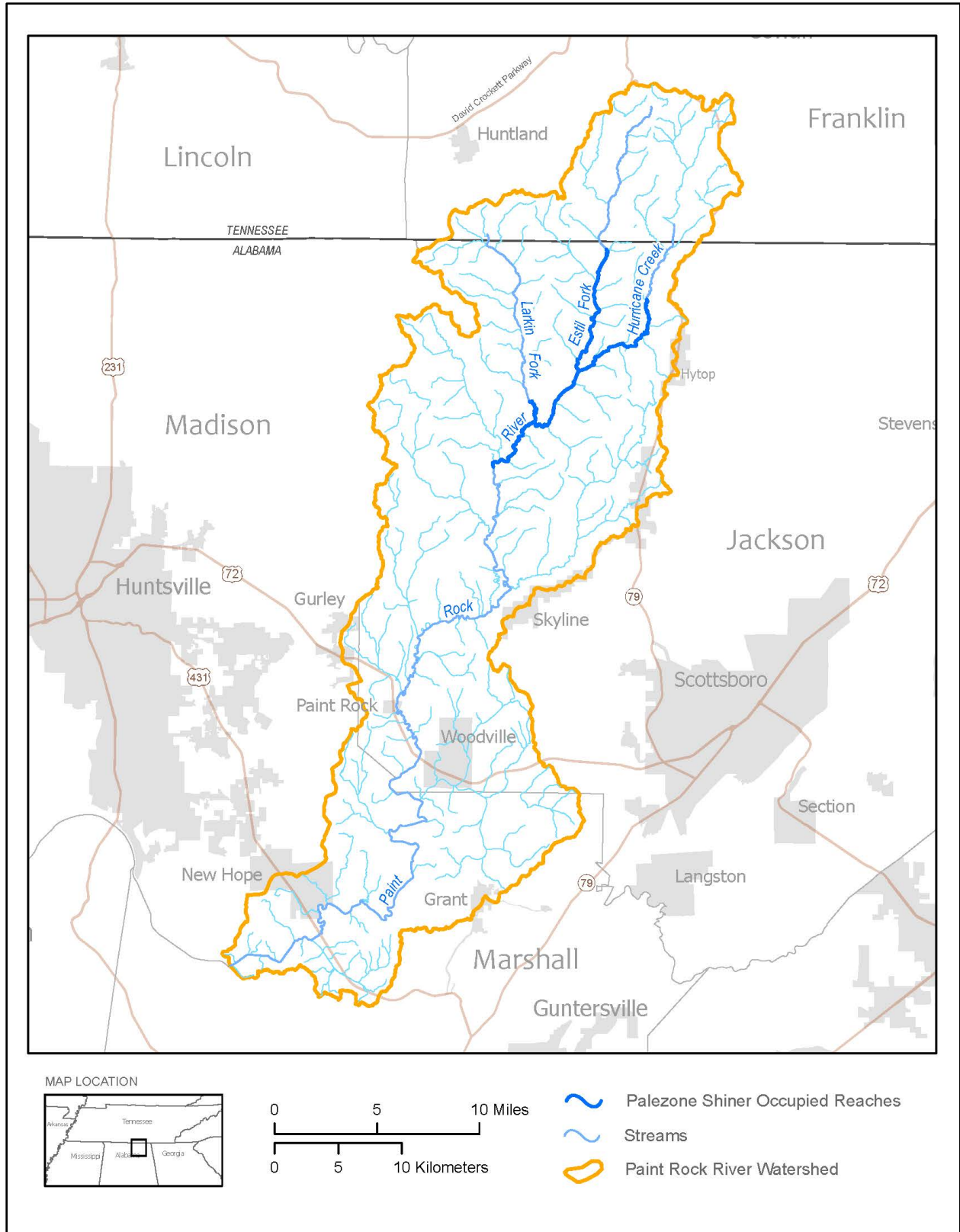


Figure 3. Palezone Shiner distribution in the Paint Rock River system, Jackson County, Alabama.

**Appendix D – Summary of 2020 Palezone Shiner Survey Results
Little South Fork, McCreary and Wayne Counties, Kentucky**

Table 1. Summary of Palezone Shiner survey results, Little South Fork, McCreary and Wayne Counties, Kentucky – July 2020¹

Site	Date	County	#	Total Length (mm)
Green Ford	07/13/2020	Wayne	4	61, 63, 63, 67
Steele Hollow Ford	07/13/2020	Wayne	4	42, 42, 45, 65
Freedom Church Ford	07/21/2020	McCreary, Wayne	35	42, 44, 46, 46, 46, 48, 48, 50, 50, 51, 51, 51, 52, 52, 52, 53, 53, 54, 55, 57, 58, 59, 61, 61, 63, 65, 65, 65, 66, 67, 68
		TOTAL	43	

¹Surveys (repeated seine hauls) completed by the Kentucky Department of Fish and Wildlife Resources, Office of Kentucky Nature Preserves, and Kentucky ES Field Office; four Palezone Shiners captured in seine hauls at Freedom Church Ford escaped before a total length measurement could be taken.

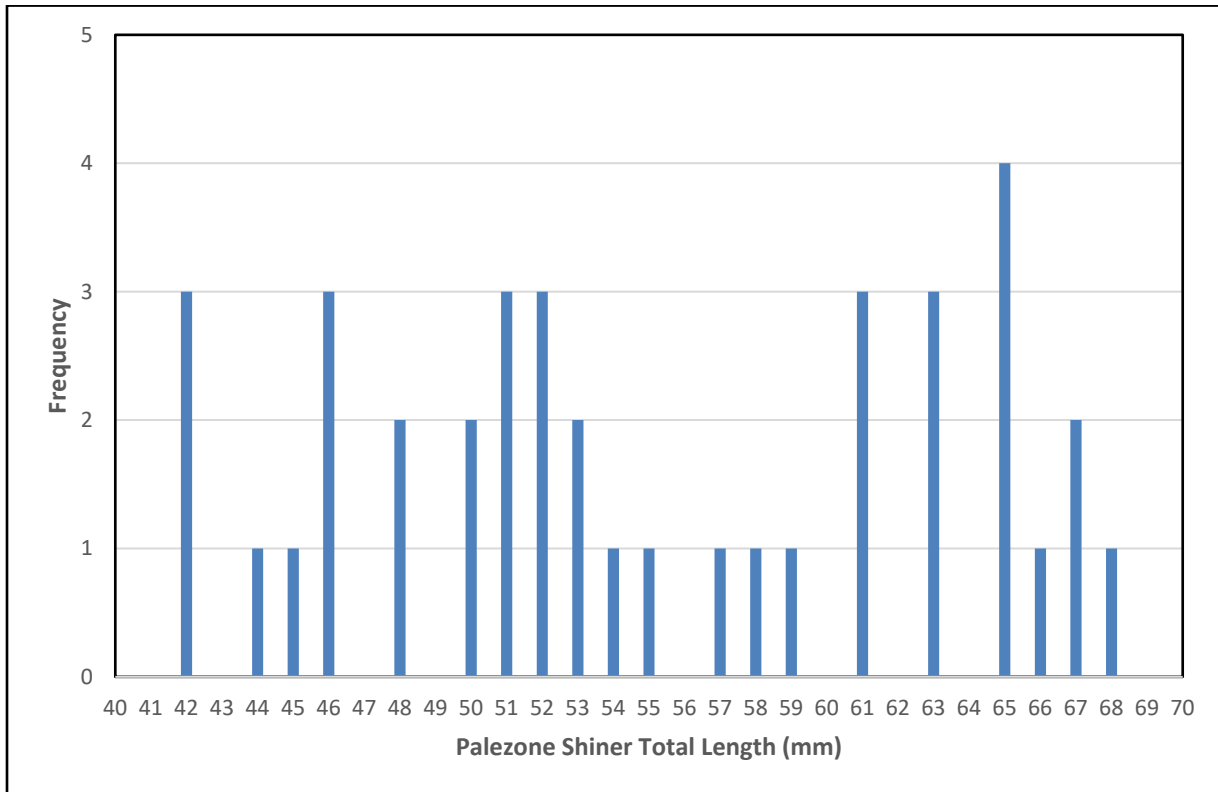


Figure 4. Size frequency histogram for Palezone Shiners collected from Little South Fork, McCreary and Wayne Counties, Kentucky in July 2020.