Cahaba Shiner (*Notropis cahabae*)

5-Year Review:
Summary and Evaluation

Cahaba Shiner, from *Fishes of Alabama and the Mobile Basin*, Mettee, O'Neil, and Pierson 1987.

U.S. Fish and Wildlife Service
Southeast Region
Mississippi Ecological Services Field Office
Jackson, Mississippi

5-YEAR REVIEW
Cahaba shiner (*Notropis cahabae)*

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on the best available information pertaining to historical and current distributions, life histories, and habitats of this species. We announced initiation of this review and requested information in a published *Federal Register* notice with a 60-day comment period (74 FR 31972). We conducted an internet search, reviewed all information in our files, and solicited information from knowledgeable individuals familiar with this species including those associated with academia and State conservation programs. Specific sources included the final rule listing this species under the Endangered Species Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by the U.S. Fish and Wildlife Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. The completed draft was sent to other associated Service offices and peer reviewers. Comments were evaluated and incorporated, as appropriate, into this final document (see Appendix A). No public comments were received.

B. Reviewers
Lead Region – Southeast Region: Kelly Bibb, 404-679-7132

Lead Field Office – Mississippi Ecological Services Field Office: Daniel J. Drennen, 601-321-1127

Cooperating Field Office – Alabama Ecological Services Field Office: Jeff Powell, 251-441-5858.

C. Background

1. Federal Register Notice citation announcing initiation of this review: July 6, 2009. (74 FR 31972)

2. Species status: Stable**.** Based on information within our files, relative abundance site specific data and minor improvements in habitat indicate no significant change in status over the last 5 years.

3. Recovery achieved: 1 (0-25% species' recovery objectives achieved). The discovery of a new population within the Locust Fork watershed has possibly increased the recovery chances of the species, along with minor site specific habitat improvements within the Cahaba River system. There have been some site

specific improvements in water quality of specific reaches and greater awareness of water quality issues through implementation of TMDLs (Total Maximum Daily Load) for nutrients and pathogens.

4. Listing History

Original Listing
FR notice: 55 FR 42961
Date listed: October 25, 1990
Entity listed: species
Classification: endangered

5. Review History:

Recovery Plan: 1992
Recovery Data Call: 1998-2015

6. Species' Recovery Priority Number at start of review (48 FR 43098): 2

Degree of Threat: High
Recovery Potential: High
Taxonomy: Species

7. Recovery Plan:

Name of Plan: Cahaba Shiner (*Notropis cahabae*) Recovery Plan
Date issued: April 23, 1992

II. REVIEW ANALYSIS

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

1. Is this species under review listed as a DPS? No.

2. Is there new information that would lead you to consider listing the Cahaba shiner as a DPS in accordance with the 1996 policy? No.

B. Recovery Plan and Criteria

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

Yes. The recovery criteria, though, could use greater detail and explanation.

2. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available information on the biology of the species and its habitat?
Not entirely, the criteria need further development. The capture rate described in the recovery plan for the species is not an adequate measure to assess the population status and dynamics.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes.

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.

The Cahaba shiner will be considered for reclassification when the following criteria are met:

Criteria 1: The Cahaba shiner occurs in numbers that allow the capture of at least 5 per hour with the use of a 12 foot seine in suitable habitat throughout the 76 miles of historical range (Note: the Locust Fork population was unknown at the time of listing and drafting of the Cahaba shiner Recovery Plan).

Status: Criteria partially met.

The last range wide surveys of the species within the Cahaba River watershed were conducted in 1992-93 (Shepard *et al.* 1994). Relative abundance stream/river site and reach surveys or assessments have occurred sporadically over the last 15 years (O'Neil, pers. comm., 2014; Kuhajda 2008, pers. comm. 2007; Honavar 2003; Howell and Davenport 2001). A status survey of the species within the Locust Fork watershed occurred in 2001 (Shepard and O'Neil 2001). The rationale of reclassification to threatened based on a capture rate of 5 specimens per hour using a 12 foot seine is not supported by pertinent scientific literature. A revised capture rate is needed along with an updated population viability analysis (Ralls *et al.* 2002).

Cahaba River Mainstem

Collection information since listing (1990) suggests a sporadic distribution of the species in the Cahaba River. Kuhajda (pers. comm., 2012) speculated that Cahaba shiners were more abundant in the Cahaba River because of recent increases in collection rates and range extensions. Specifically, Kuhajda collected 18 Cahaba shiners in eight attempts between 2009 and 2011 within the Cahaba River mainstem. A total of 54 Cahaba shiners were collected at six sites in the Cahaba River mainstem during spring 2007. Eighteen of those Cahaba shiners were collected at the former Marvel Slab site (Kuhajda 2007). From summer 2005 to spring 2006, 14 Cahaba shiners were found at the Marvel Slab site; only 5 were found in spring 2006 at the exposed riffles created from the slab removal (Kuhajda 2007).

Shades Creek

Site specific collections have gauged relative abundance of Cahaba shiners in some lower reaches of Shades Creek (a tributary of the Cahaba River; not included in the Recovery Plan) at the old railroad box car culverts (Kuhajda 2012). The species had been collected just downstream of the box car culverts in 2008 (Kuhajda 2012). No Cahaba shiners were collected upstream of the boxcar removal site during spring 2008 (Kuhajda, pers. comm., 2008) and after the box cars were removed from Shades Creek in 2011 (Kuhajda 2012). However, three individuals were collected at the box car site in 2014 based on personal communications from species experts.

Locust Fork of the Black Warrior River

The Cahaba shiner was discovered in 1998 within 13 of 39 main channel sampling stations of the Locust Fork. This represented the first record of the species from the Locust Fork. The highest number of Cahaba shiners collected at any collection station in the Locust Fork was 68 captures in 1.5 hours near Warrior, Alabama. This is roughly 45 individuals per hour collected using an 8 or 10 foot 3/16 inch mesh seine singly and in conjunction with a portable backpack shocking unit (Shepard and O'Neil 2001); far surpassing the benchmark of 5 individuals collected per hour for the Cahaba River described in Criteria 1. Although this criteria has been met, the significance of this collection rate index required by the criteria is unknown and has not been studied in relation to the viability of the population as a whole.

The species may have been present in the main stem of the Black Warrior River as far downstream as Tuscaloosa, where an associate species, the coal darter (*Percina brevicauda*) was collected in 1889 before

impoundment (Shepard and O'Neil 2001). Distribution in the Locust Fork includes 118 km (73 mi) along with the lower 8 km (5 mi) of the Blackburn Fork (Shepard and O'Neil 2001).

Criteria 2: Populations are documented to be viable over 10 years (a viable population is defined as having the reproductive capability to sustain itself without immigration of individuals from other populations.)

Status: Criteria partially met.

Although there have been relative abundance, presence/absence and site check surveys, indicating the locations of the species, the Cahaba shiner populations have not been documented as statistically viable over time at any site.

The minimum viable population size (the lowest population below which growth in the population is negative; Soule 1980) needs to be defined for this shiner along with population metrics such as age/sex ratios, age classes, collection numbers, mortality and natality, to determine the population viability analysis (PVA) (Patterson and Murray 2008, Ralls *et al.* 2002). Statistical confidence intervals need to be established in order to propose viable benchmarks of the species populations to indicate species health along with the inclusion of factors identified for persistence in populations and stochastic factors (demographic, environmental and genetic) and deterministic factors (habitat loss based on land management and water quality and water quantity threats).

Some Cahaba shiners were noted to move between habitats that had been historically disconnected for many years above and below the Marvel Slab site in the Cahaba River (2006), due to the removal of the dam, and the railroad cars in Shades Creek (Kuhajda, pers. comm., 2011). Removal of fish passage obstruction is very beneficial to this species for connectivity within the main stem of the Cahaba River and Locust Fork. Over time these types of responses to management techniques and habitat improvements will increase the viability of the species population by providing access to more habitat and genetic exchange between subpopulations.

Criteria 3: The Cahaba River drainage is protected from water quality degradation. [Protected is defined as having enough control over the geographic area in question that adverse impacts are unlikely to occur.]

Status: Criteria partially met.

Improvements in site specific water quality (Marvel Slab and box car sites), and plans to aggressively monitor and improve poor water quality parameters in the Cahaba River (e.g. TMDLs for the Cahaba River Watershed 2013, 2006; Alabama Clean Water Partnership 2011) outside of publically own land, have resulted in marginal improvement.

The Cahaba River National Wildlife Refuge (U.S. Fish and Wildlife Service 2013, 2007) in Bibb County, conserves, enhances and restores native aquatic and terrestrial habitats in the Cahaba River. The refuge protects about 37,833 ha (93,489 acres) and approximately 4.8 km (3 mi) of the Cahaba River or about 17% of the species' Cahaba River range (tabulated from Kuhajda and Shepard, 2004).

Technical support for stormwater management, pollution control, habitat enhancement and other projects within the watershed are provided to landowners and governmental agencies from the U.S. Fish and Wildlife Service, U.S. Forest Service, The Nature Conservancy, U.S. Geological Survey, Natural Resource Conservation Service, Alabama Department of Environmental Management (ADEM), and the Alabama Department of Conservation and Natural Resources. Abundant technical watershed based, river management and conservation plans, including the identification of TMDLs and monitoring of water quantity and quality parameters are available (Cahaba River/Lake Purdy Watershed Protection Policy 2012; Friends of Shades Creek 2008; USFWS 2007; ADEM 2013 2006, 2004; Alabama Clean Water Partnership 2011; McKinney 2006; Cahaba River Society 2005; Black Warrior River Watershed Management Plan 2003).

Community action, grass roots and non-profit conservation groups (e.g. Cahaba River Society, Alabama Rivers and Streams Network, Alabama River Alliance, Black Warrior River Keeper) strive to protect water quality and quantity by actively being part of the watershed monitoring for any obvious threats and also occasional water quality monitoring projects. These groups network with State, Federal, city and county governments; outreach to the public and landowners; conduct natural resource inventories and surveys; and try to regulate adverse actions toward striving to meet water quality and quantity standards. Community action also continues school and group outreach.

C. Updated Information and Current Species Status

Biology and Habitat

The Cahaba shiner is restricted to the upper main stem of the Cahaba River and immediate lower reach with Shades Creek. The species is found

sporadically in appropriate habitat in about 122 river km (76 mi) of the Cahaba River, from about 4.8 km (3.0 mi) northeast of Heiberger (Bibb County) to 2.3 km (3.7 mi) above Booth Ford (Shelby County) near Helena. The Cahaba shiner was discovered in the main channel of the Locust Fork drainage of the Black Warrior River in 1998. The species is present in an 118 km (73 mi) reach of the Locust Fork drainage, from near Nectar (Blount County) downstream to about 4.5 km (2.8 mi) SW of Sayre (Jefferson County) and in the lower 8 km (5 mi) of the Blackburn Fork (Blount County) (O'Neil, pers. comm., 2014; Boschung and Mayden 2004; Stiles 2004; O'Neil 2002; Mayden and Kuhajda 1989).

Cahaba shiner surveys from 1976 to 2010 using seines, dip-nets and backpack shockers, found 0 to 118 individuals per collection effort (Southeastern Fishes Council Proceedings 2010, Stiles 2004, Mayden and Kuhajda 1989). Many survey reports do not list results as Cahaba shiners collected per time, but as cumulative totals of individuals collected per station or site, making it difficult to convert and extrapolate the individuals per site information to individuals per hour unit. This problem, along with a historical absence of a Cahaba shiner population viability analysis and metrics, cannot adequately estimate viability (Patterson and Murray 2008, Ralls *et al.* 2002) of the species populations. However knowing and maintaining the Cahaba shiner population's viability over time with the potential for the population to adapt and evolve over time, are essential to their sustainability demographically (Hallerman 2003).

Principal habitat for the species includes the main channels of the Cahaba River and Locust Fork, where shoal microhabitats predominate (Stiles 2004). The species is typically found in microhabitats of quiet, shallow backwater, just below, or adjacent to riffles and runs primarily over clean sand-gravel substrates (Stiles 2004, Mayden and Kuhajda 1989). Cahaba shiners have also been collected from shallow water depths of 0.25 to 1.5 m (9.8 in to 59 in), and also from large shoals and from 2 or 3 cm (0.8 to 1.1 in) of water in water-willow (*Justicia)* beds adjacent to a swift riffle. The species moves into the lower reaches of small tributaries during periods of rapidly rising water and prefers the large shoal areas of the main channel and quieter waters below swift riffle areas (Stiles 2004, Mayden and Kuhajda 1989).

Genetics

Kuhajda *et al.* (2001) found no differences of standard morphological characters between the two populations of Cahaba shiners in the Cahaba River and Locust Fork. However, Kuhajda *et al.* (2001) did find that there are some phylogenetic differences of mitochondrial DNA cytochrome-b sequence data between these two Cahaba shiner populations (cytochrome b is commonly used as a region of mitochondrial DNA to determine

phylogenetic relationships between organisms due to its sequence variability). It is considered to be most useful in determining relationships within families and genera). Also the two populations are considered reciprocally monophyletic (all lineages within each group share more-recent common ancestors from any lineage from one group shares with any lineage from the other group, Paetkau 1999). Average genetic divergence (p-distance) between these two populations appears to be three times that of within population divergence indicating that Cahaba shiners from the Cahaba and Black Warrior drainages are Evolutionary Significant Units (Kuhajda *et al.* 2001), but the same taxonomic entities.

2. Five-Factor Analysis

a. The present or threatened destruction, modification, or curtailment of its habitat or range: The species' range at the time of listing in 1990 included 96 km (60 mi) of the Cahaba River watershed. In 1999, the species' range was more than doubled with the discovery of the Locust Fork population which added 118 km (73 mi) of the Locust Fork of the Black Warrior River and 8 km (5 mi) in Blackburn Fork, a tributary to the Locust Fork (Kuhajda and Shepard 2004).

Cahaba shiner populations in most parts of their range are at the same general levels as in 1989 (Jelks *et al.* 2008). Overall, the Cahaba River fauna *in totalis* has marginally improved since listing (O'Neil, pers. comm. 2014), but significant threats continue.

In general, the Cahaba River has shown marginal improvement in water quality over the last 15 years. However, several studies of the upper Cahaba River watershed identify occasional impairments of the rivers' designated uses by siltation from urbanization and eutrophication from municipal wastewater sources and nonpoint sources (O'Neil 2002, USEPA 2003). Episodes of poor water quality and low water quantity with a high potential of non-point source pollution due to urbanization, (ADEM 2013, 2006) also occur sporadically and likely impact the species

As recently as 1998 through 2006, four segments in the upper third of the watershed, encompassing 2660 km² (1027 mi²) of drainage area including the City of Birmingham were listed as impaired due to siltation and nutrients, habitat alteration and pathogens (ADEM 2013, 2006). Historical changes in geomorphology and habitat along with urbanized landscape changes continue to add stress to the watersheds in the species' range (Powers 2008, Kuhajda 2007, Howard *et al*. 2002, Stiles 2000, U.S. Fish and Wildlife Service 1992, Stiles 1990, Pierson *et al*.1989, Stiles and Ramsey 1986, Howell *et al*. 1982, Stiles 1978, Ramsey 1976).

Cahaba River Range

Specific biological data indicates that the health of the aquatic community structure upstream, within, and downstream of the Cahaba Shiner range varies from fair to poor based on species diversity, benthic community structure, and biological condition (ADEM 2013, 2006). Siltation (sedimentation) in stormwater runoff from urbanized areas and eutrophication from nutrient loading by municipal wastewater and non-point sources (ADEM 2013, 2006; U.S. Environmental Protection Agency 2003, 2000 1979; ADEM 2004; Shepard, pers. comm., 2011; Shepard and O'Neil 2001) are the main causes of water quality degradation in most river systems. Sedimentation is intensified by silviculture, livestock production, and by re-establishing coal mines and their infrastructure (Howard *et al.* 2002).

Studies in general show that increased urbanization leads to declining water quality in streams and fish assemblages (Onorato *et al*. 2000, Anderson *et al*. 1995, Waters 1995, Weaver and Garman 1994). In particular, Honavar (2003) observed a negative correlation between water quality (sedimentation) and percent relative abundance of crevice spawning minnows and darters in the Cahaba River system. Historically, point- and non-point source pollution have resulted in decreased water quality coinciding with extirpation of the blue shiner (*Cyprinella caerulea*) and other aquatic species from the Cahaba River (U.S. Environmental Protection Agency 2000, Sheppard *et al*. 1994, Pierson and Krotzer 1987, O'Neil 1984, Howell *et al*. 1982, Ramsey 1982, U.S. Environmental Protection Agency 1979). Impairment of aquatic life in the Cahaba River has been related to nutrient over-enrichment (eutrophication)compounded by sedimentation and extremes in prevailing hydrologic patterns as reflected in increased diurnal dissolved oxygen fluctuations at Piper Bridge (the upper mid-range of the species (O'Neil 1984).

After the Marvel Slab site (Shelby County) was removed in 2005, there was improved water quality, stream flow, fish passage and the formation of two substantial riffle habitats reconnecting parts of the Cahaba River that were previously unavailable to the Cahaba shiners. No Cahaba shiners were collected upstream of the railroad cars during spring 2008 (Kuhajda, pers. comm., 2008) and none collected in Shades Creek in 2011, after the railroad cars were removed (Kuhajda 2012).

Locust Fork of the Black Warrior River Range

In the Locust Fork watershed, adverse impacts occur throughout the basin (e.g. mining activities, industrialization, and municipal pollution from the Birmingham metropolitan area and other cities in the watershed; poor agricultural and silviculture practices near Sand Mountain). Fifteen of 27 water quality stations sampled in the watershed were ranked by the Geological Survey of Alabama as poor or very poor based on low levels of dissolved oxygen or poor biological condition (Black Warrior River Watershed 2003, Shepard *et al.* 1994). Contrary to this, some more recent surveys in seven sites of the Locust Fork suggests improvement in the sampled river reach based on fair to excellent in total Index of Biological Integrity scores (O'Neil, pers. comm., 2012, Shepard *et al*. 2004). However, the potential for declining water quality continues to exist due to the proximity of the species' range to major urban areas and the associated stormwater flows which contribute to increased turbidity, siltation, nutrient and other chemical runoff (ADEM 2013, 2006).

Coal Mining Activities

Even though coal mining activities are not specifically pointed out in the Cahaba Shiner Recovery Plan (U.S. Fish and Wildlife Service, 1992), threats from surface mining and drilling are mentioned as methane gas extraction and nonpoint and point source water pollution with heavy metals (which would be from mining or drilling activities).

The Warrior Coal Basin, the southernmost coal deposit in Appalachia and the largest coal basin in Alabama, partially lies underneath a large section of the upper Cahaba River and Locust Fork watersheds (Hewitt 1984).

Thus far, there have been no pollution events impacting the species that are attributed to coal mining and related methane drilling. However, there is abundance of coal mining operations within close proximity of the river, as it was during the listing in 1990 (55 FR 42961). This has the potential to threaten the species as it may have in 1989 from coal bed methane drilling (Stiles 1990). In 140 river km (76 mi) of the Cahaba River, there are 9 active mines (755 ha; 1868 ac), 77 surface mine ponds (46 ha; 114 ac), and over 38.6 km (24 mi) of mining roads. Within the Cahaba Shiner's range in about 118 km (73 mi) reach of the Locust Fork drainage of the Black Warrior River, there are 8 active mines 1259 ha; 3111ac), 62 surface mine ponds (34 ha; 84 ac), and over 51.5 km (32 mi) of mining roads (Johnson, pers. comm., 2014).

Strip mining for coal results in erosion, sedimentation, groundwater level decline, and general degradation of water quality that affects many aquatic organisms (U.S. Fish and Wildlife Service, 2000). Impacts associated with present and historical mining activities include leakage of sediment ponds

and mine tailing (Mathis 2007, Diehl *et al.* 2004). Runoff from coal surface mining generates pollution through acidification, increased mineralization, and sediment loading. Due to high demand for coal, watersheds within the Cahaba and Plateau Coal Fields of the Warrior Coal Basin have historically been partially impaired by means of degraded water quality caused by heavy metals, acids, and sediment run off from active and abandoned coal mines.

Mining resulting in heavy benthic siltation, elevated metal concentrations and altered pH levels, may have caused habitat fragmentation of the species. Continuing these actions, even sporadically, may increase disturbances to the species genetic compositions thereby increasing the probability of extirpation. In general, habitat loss and fragmentation amplifies threats from stochastic events such as point and nonpoint source water and habitat quality degradation, accidental spills and violations of permitted mine discharges (Mathis 2007, Diehl *et al.* 2004, Dodd 1988).

The Northern Beltway

The 52-mile Northern Beltline corridor begins at the Interstate 20/59/459 interchange southwest of Bessemer. The route goes in a northeast direction, intersecting future Interstate 22/U.S. 78, Interstate 65, U.S. 31, Alabama 79, and Alabama 75 before heading southeast toward its eastern terminus with Interstate 59 near Exit 143 in the vicinity of Trussville (http://www.interstate-guide.com/i-422_al.html). The northeastern and due north sections of the beltway have been completed and the other sections are scheduled to begin within the next few years.

The corridor will permanently alter portions of Black Warrior and Cahaba river streams and wetlands in 125 places, 90 of which are in the Black Warrior River basin (ADEM 2013). Some of these crossings will be bridged while other crossings will be culverted or piped (USDOT and ALDOT 2012). Almost 90% of the Beltline corridor is undeveloped and the majority of the interstate will go through forested lands, destroying about 1639 ha (4,050 acres). Given the steep topography, intense rain events of the area and the highly erodible of soils in the upper Cahaba basin, this area has some of the highest potential for severe erosion in the United States. In addition, the Cahaba River is on the state 303 (d) list of impaired waters due to excessive sedimentation (ADEM 2013).

Long term impacts and secondary development from the Northern Beltline project includes the conversion of land from its current use (mostly undeveloped) to paved surface for the width of the roadway and the vegetation cleared out of the project's right of way boundary. This change in land use typically results in accelerated storm water runoff into streams.

Depending on the amount of land that was converted from a natural condition to a paved surface within the drainage area of a stream, the stream may experience increased water velocities that result in streambed and bank erosion and degradation, sediment and pollutant loading, and other morphological changes runoff (USDOT and ALDOT 2012).

b. Overutilization for commercial, recreational, scientific, or educational purposes: The species is not commercially utilized. At the time of listing, overutilization was not deemed to be a threat to this fish. Individuals have been taken for scientific and private collections in the past, but collecting is not considered a factor in the decline of this species and is not expected to be so in the future.

c. Disease or predation: Disease is not considered to be a factor in the decline of the Cahaba shiner. Although the species is undoubtedly consumed by predators, the available information suggests that this predation is naturally occurring, or a normal aspect of the population dynamics of this fish. As a result, we do not believe that predation is considered to pose a threat to the Cahaba shiner.

d. Inadequacy of existing regulatory mechanisms:

In the State of Alabama, the species is protected by the Code of Alabama §§ 220-2-.92, which makes it unlawful to take, capture, kill, possess or sell this animal without a permit. The species is afforded some protection from water quality and habitat degradation under the Clean Water Act of 1972 (33 U.S.C. 1251 et seq.), the Alabama Water Pollution Control Act, as amended, 1975 (Code of Alabama, §§ 22-22-1 to 22-22-14, and the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87). Presently only operating mines are required to employ environmental safeguards established by the Federal Surface Mining Control and Reclamation Act of 1977 and the Clean Water Act (U.S. Fish and Wildlife Service 2000). Alabama follows traditional common-law riparian doctrine which associates the right to use water with ownership of land abutting the water (Elliott 2012).

The State of Alabama maintains water-use classifications through issuance of National Pollutant Discharge Elimination System (NPDES) permits to industries, municipalities, and others that set maximum/minimum limits on certain pollutants or pollutant parameters. The Clean Water Act requires that all municipal, industrial and commercial facilities that discharge wastewater or stormwater directly from a point source (a discrete conveyance such as a pipe, ditch or channel) into a water of the United States (such as a lake, river, or ocean) must obtain a National Pollutant Discharge Elimination System (NPDES) permit. All permits are written to ensure the receiving waters will achieve their Water Quality Standards. For water bodies on the 303(d) list, States

are required under the Clean Water Act to establish a TMDL for the pollutants of concern that will bring water quality into the applicable standard. The State of Alabama has not presently identified any impaired water bodies in Jefferson, Shelby, and Bibb counties in the immediate or upstream portion of the Cahaba shiner range or watersheds in Shelby or Bibb County.

Existing regulatory mechanisms in Alabama, as written, appear to be adequate, but observance to these regulations is not consistent. This is because of inconsistency in implementation of Clean Water Act regulations and other best management practices, which are voluntary for some activities and mandatory for others. In addition, there is a significant gap in information concerning the species' water quality tolerances to episodic declines within the species range. The increased urbanization within the watersheds, particularly the Northern Beltline construction and the forecasted ancillary industrial and commercial development, coupled with the increased mining activities exacerbate the potential for water quality degradation within the watersheds, particularly potentially catastrophic events.

Within the Cahaba River National Wildlife Refuge, Cahaba shiners are protected (17% of range within Cahaba River). The National Wildlife Refuge System Improvement Act of 1997 requires that every refuge develop a Comprehensive Conservation Plan (CCP) and revise it every 15 years, as needed. CCPs identify management actions necessary to fulfill the purpose for which a NWR was enacted. CCPs allow refuge managers to take actions that support State Wildlife Action Plans, improve the condition of habitats and benefit wildlife and in this case the Cahaba shiner. The current generation of CCPs will focus on individual refuge actions that contribute to larger, landscape-level goals identified through the Landscape Conservation Design process. CCPs address conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreation uses.

e. Other natural or manmade factors affecting its continued existence: The Cahaba shiner occurs in two distinct and non-connecting watersheds. The existing populations are localized to certain reaches of watersheds where there is appropriate habitat.

This population isolation leaves them vulnerable to localized extinctions 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 to decreased fitness from reduced genetic diversity (Noss and Cooperrider 1994, Harris 1984). Potential sources of spills include accidents involving vehicles transporting chemicals over

road crossings of inhabited by the Cahaba shiner, or the accidental or intentional release into river or tributaries of chemicals used in agricultural or residential applications. The long-term viability of the Cahaba shiner is based on conservation of numerous local populations throughout its geographic range (Harris 1984). These features are essential for the species to recover and adapt to environmental change (Noss and Cooperrider 1994, Harris 1984).

The Cahaba shiner is restricted in range and population size and its populations are considered "Evolutionary Significant Units" by Kuhajda (Kuhajda *et al.* 2001). Average genetic divergence (p-distance) between the Cahaba River and the Locust Fork populations is three times that of within the same population divergence. This indicates that the species is 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 (Soule 1980, Hunter 2002, Allendorf and Luikart 2007). Isolation of the species makes natural repopulation following localized extirpations virtually impossible without human intervention.

Climate change has the potential to increase the vulnerability of the Cahaba shiner to random catastrophic events (e.g., McLaughlin *et al*. 2002, Thomas *et al.* 2004). Climate change is expected to result in increased frequency and duration of droughts and the strength of storms (e.g., Cook *et al*. 2004). Climate change could intensify or increase the frequency of drought events, such as the one that occurred in 2007 in Alabama. Thomas *et al*. (2004) report that the frequency, duration, and intensity of droughts are likely to increase in the southeast as a result of global climate change.

D. Synthesis

Many of the threats present at the time of listing still remain but to a lesser degree in some river reaches. We have made progress on recovery implementation with improvements to the species' status and range including the discovery of an additional population within the Locust Fork watershed; site specific relative abundance increase; some improvements of connectivity and fish passage and; momentary improvement in general water quality by TMDL designations in the Cahaba River system.

Even though we have gained a better understanding of the distribution of the species and have found that its range is larger than previously believed, the species' range is influenced by a large urban zone of intensive development within the greater Birmingham metropolitan area and is not secure from threats.

Enforcement of water quality regulations is inadequate. Particularly poignant is data suggesting that the overall health of the aquatic community structure, including the reaches occupied by the Cahaba shiner is fair to poor based on basic biological parameters. Sedimentation in stormwater runoff from urbanized areas, eutrophication from nutrient loading by municipal wastewater and non-point sources, as well as increased coal strip mining continue to contribute to general degradation of water quality.

In summary, though there have been some improvements in the species' numbers and habitat at selected sites, due to the lack of long-term monitoring, we are unable to document that current populations are viable. In addition, we are unable to document that water quality degradation no longer poses a threat to this species. Therefore, the Cahaba Shiner continues to meet the definition of endangered species under the Act.

III. RESULTS

A. Recommended Classification:

No change is needed.

B. New Recovery Priority Number: 8

Degree of threat has been reduced to "moderate" due to discovery of an additional population in the Locust Fork River which has added 118 km (73 mi) to its range and to improvements in water quality in the Cahaba River. The recovery potential continues to remain "high".

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Initiate long-term monitoring and population viability analysis of the species at sites within the Cahaba River and Locust Fork River basins.
2. Continue to survey suitable habitat within the Cahaba River and Locust Fork River basins for Cahaba shiners.
3. Explore the use of new technology in surveying, specifically environmental DNA survey methods.
4. Work to obtain protection for riverine and tributary buffering on privately owned lands specifically by forming relationships with landowners and working with conservation groups, state, county and town governments.
5. Establish best management and conservation practices to improve water quality and water quantity issues by reducing stormwater runoff, sediment and eutrophication.

6. Formalize protection through cooperative agreement, conservation easement, fee title purchase or other means to guarantee safeguards to the water quality, especially turbidity, water quantity, geomorphology, hydrology and other aspects of the habitat and natural history of the species.
7. Enforce existing regulations and land management laws along with implementation of existing conservation and water quality and water quantity plans.
8. Devise a husbandry and augmentation plan for existing Cahaba shiner populations in both systems and begin propagation, husbandry and maintaining captive colonies of the species.
9. Revise recovery plan.

V. REFERENCES

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Dr. Bernie Kuhajda, Tennessee Aquarium Conservation Institute. Chattanooga, TN. September, 2011. Telephone conversation with Daniel Drennen concerning expansion of Cahaba shiners at Boxcar site.

Dr. Bernie Kuhajda, University of Alabama. Tuscaloosa, AL. July 21, 2008. Memo to Jackson Field Office of collections from Cahaba River at, above, and below the Marvel Slab 2005-07, and Shades Creek 2006-08.

Dr. Bernie Kuhajda, University of Alabama. Tuscaloosa, AL. 2007. Telephone conversation concerning relative abundance stream/river site and reach surveys of Cahaba shiners over the last 15 years.

Dr. Pat O'Neil, Alabama Geological Survey, Tuscaloosa, AL. May, 2014. Email to Daniel Drennen concerning Cahaba shiner populations in the Cahaba and Locust Fork River.

Dr. Pat O'Neil, Alabama Geological Survey, Tuscaloosa, AL. September 26, 2012. Telephone conversation with Daniel Drennen concerning Cahaba shiner populations in the Cahaba and Locust Fork River.

Tom Shepard, Geological Survey of Alabama. Tuscaloosa, AL. June 2011. Memo to Jackson Field Office about Cahaba shiner collections from Locust Fork in 2010. 3 pgs.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
of
Cahaba shiner (*Notropis cahabae*)

Current Classification: Endangered.

Recommendation resulting from the 5-Year Review:

__X__ **No change needed**

Review Conducted By: Daniel Drennen, Mississippi Ecological Services Field Office.

FIELD OFFICE APPROVAL:

for **Lead Field Supervisor, Fish and Wildlife Service**

Approve Cary Norquist Date 9/9/15

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve Lisa Ellis Date 4/29/16

Appendix A. Summary of peer review for the 5-year review of Cahaba shiner (*Notropis cahabae*)

A. **Peer Review Method:** The Service conducted peer review. Eight peer reviewers were selected by the Service for their knowledge of and expertise with the Cahaba shiner. The peer reviewers selected are identified below.

Peer Reviewers:

Dr. Bernard Kuhajda
Aquatic Conservation Biologist
Tennessee Aquarium Conservation Institute
201 Chestnut Street
Chattanooga, TN 37402-1014

Steve Rider
River and Stream Fisheries Lab
Alabama Division Wildlife and Freshwater Fisheries
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Dr. Randall Johnson
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Dr. Pat O'Neil
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Aquatic Biologist
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Tuscaloosa, AL 35486-6999

Nelson Brook
Black Warrior Riverkeeper
712 37th Street South
Birmingham, AL 35222

Dr. Mike Howell
Professor Emeritus
Department of Biological and Environmental Sciences
Samford University
Birmingham, AL 35229

B. Peer Review Charge: The below guidance was provided to the reviewers:

1. Review all materials provided by the Service.
2. Identify, review, and provide other relevant data apparently not used by the Service.
3. Not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.
4. Provide written comments on:

- Validity of any models, data, or analyses used or relied on in the review.
- Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
- Oversights, omissions, and inconsistencies.
- Reasonableness of judgments made from the scientific evidence.
- Scientific uncertainties by ensuring that they are clearly identified and characterized and that potential implication of uncertainties for the technical conclusions drawn are clear.
- Strengths and limitation of the overall product.

5. Keep in mind the requirement that the Service must use the best available scientific data in determining the species' status. This does not mean the Service must have statistically significant data on population trends or data from all known populations.
6. All peer reviews and comments will be public documents and portions may be incorporated verbatim into the Service's final decision document with appropriate credit given to the author.

C. Summary of Peer Review Comments/Report:

Four of the eight peer reviewers provided comments. Overall, peer reviewer comments were supportive of the information presented in this review. All believed that it used the best available science. Dr. O'Neil of the Geological Survey of Alabama and Dr. Kuhajda of The Tennessee Aquarium provided unpublished field notes of collection data for the species and possible threats to the species in the Locust Fork and Cahaba River watershed. The peer reviewers provided editorial comments and additional information along with clarification of range of the Cahaba

Shiner and threats to the species. Peer reviewers expressed concern over the lack of funding to support long-term monitoring and regular sampling sessions for the species.

D. Response to Peer Review:

Comments and concerns received from peer reviewers were addressed and incorporated into this 5-year review as appropriate, grammatical errors were corrected, various sentences were revised for clarity, localities were clarified and citations updated. Additional information was included concerning location data within Shades Creek and the Locust Fork watershed. Specifically the Service acknowledges the lack of sampling consistency and need for long term efforts. Every effort is made to maintain monitoring of the species however funding for such efforts are not within the field office control.

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