Goldline Darter
(*Percina aurolineata*)

5-Year Review:
Summary and Evaluation

Photo by Tennessee Aquarium Conservation Institute.

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U.S. Fish and Wildlife Service
Atlanta Regional Office
Georgia Ecological Services Field Office
Athens, Georgia

5-YEAR REVIEW
Goldline Darter (*Percina aurolineata*)

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 contemporary distributions, life histories, genetics, habitats, and threats of this species. We announced initiation of this review and requested information in a published *Federal Register* notice with a 60-day comment period (85 FR 16951). We received two public comments during the 60-day open comment period and both expressed general concern for the species and referenced studies on implementation of state forestry best management practices. We used a variety of information sources, including peer-reviewed publications, Natural Heritage databases of species occurrences, and solicited expertise from knowledgeable professionals associated with academia and State conservation programs. Specific sources included the final rule listing this species under the Endangered Species Act (ESA) (57 FR 14786); the recovery plan (USFWS 2000); peer reviewed scientific publications; unpublished field observations by Federal, State, and other experienced biologists; unpublished studies and survey reports; and notes and communications from other qualified individuals. The completed draft review was sent to cooperating U.S. Fish and Wildlife Service field offices for review. Comments were evaluated and incorporated into this final document as appropriate.

B. Reviewers

Lead Region: South Atlantic-Gulf Region, Carrie Straight, 404-679-7266

Lead Field Office: Georgia Ecological Services Field Office, Eric F. Bauer 706-613-9493, Scott Glassmeyer 706-208-7533 and Martha Zapata 706-208-7524.

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:** March 25, 2020. 85 FR 16951.

2. **Listing History:**
   Original Listing
   FR notice: 57 FR 14786 (FR Doc. 92-9393)
   Date listed: April 22, 1992
   Entity listed: Species
   Classification: Threatened

3. **Associated rulemakings:** None

4. **Review History:**
   Final Recovery Plan: 2000
   Recovery Data Call: Annually from 1998-2020

5. **Species' Recovery Priority Number at start of review (48 FR 43098): 8**
   Degree of Threat: Moderate
   Recovery Potential: High
   Taxonomy: Species

6. **Recovery Plans**
   Name of Plan: Recovery Plan for Mobile River Basin Aquatic Ecosystem
   Date Issued: November 17, 2000

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 goldline darter 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?** No. The current recovery plan for the goldline darter does not mention its Georgia population.
   b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?**

   Yes. Recovery criteria for the goldline darter in the *Recovery Plan for Mobile River Basin Aquatic Ecosystem* (USFWS 2000) primarily addresses the listing factors related to destruction, modification, and curtailment of its habitat and range mediated by natural and human-induced (e.g., impaired water quality, reservoir construction) stressors. Overutilization, disease or predation, and regulatory mechanisms were not relevant concerns for the species during listing.

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 recovery plan focuses on the Alabama population, but recovery criteria are also applicable for the Georgia population. We will consider delisting the goldline darter when the following criteria are met:

Criteria 1: The known populations of the species are shown to be stable or increasing for a period of at least five years.

Status: Criteria partially met. Population viability or population trend analyses required to determine the stability of the extant populations in Georgia and Alabama have not been conducted.

Cahaba River. Collections of goldline darter from 2016-2019 in the Cahaba River and its tributaries suggest this population is also stable because multiple age classes were collected from most sampled sites and the species was relatively abundant (Fix and Kuhajda 2019). Additionally, occurrences of the goldline darter have increased, and it may be expanding its range northward in the Cahaba River and its tributaries (ADEM 2019, 2020). However, there are no recent collections of this species south of Centreville, Alabama, which may suggest that the species' range is contracting in the south.

Coosawattee River. Occurrence data before (1996-2000) and after (2009-2011) rapid development of the Coosawattee watershed in Georgia indicated no evidence of decline in the upper Coosawattee River, but goldline darters may be extirpated from the lower Coosawattee River in the time prior to the last 5-year review (Albanese et al. 2014). More recent (2016-2019) surveys in the upper Coosawattee River documented multiple age classes of the species at 14 of 15 previously known sites, which suggests these populations may be stable over the last four years (Fix and Kuhajda 2019).

Criteria 2: There has been a demonstrated trend in water quality improvement in the reach of the Cahaba River occupied by this fish.

Status: Criteria partially met.

Cahaba River. The Cahaba River continues to have water quality impairments (ADEM 2013a; Gangloff 2017). Sedimentation in stormwater runoff from urbanized areas and eutrophication from nutrient loading by municipal wastewater and non-point sources have led to water quality degradation (ADEM 2013a, b, 2019). However, reductions in total phosphorous and a shift in diatom assemblages indicate improved water quality in the Cahaba River from 2005 to 2016 (ADEM 2019). In contrast to diatom assemblages, aquatic invertebrate and fish assemblages have not shown improvements from 2005 to 2016 which likely reflects the continued impacts of siltation (ADEM 2019).

Coosawattee River. Although this criterion does not mention the Coosawattee River, it should be applied to management of the Georgia population of the goldline darter as well. Nutrient loading in the Coosawattee River basin is related to municipal and agricultural sources. More than 200 cattle and poultry operations are likely contributing waste from poultry litter and cattle, which leads to higher levels of fecal coliform bacteria and higher costs for water treatment (Tarter 2005; Fulmer and Fowler 2007; Jovanelly 2011). Siltation also is an ongoing threat to the species and its habitat in the upper Coosawattee River, especially in the Ellijay River (Fix and Kuhajda 2019). Portions of the Ellijay River are also affected by non-point pollution sources and urban runoff, which results in negatively impacted biological communities and high levels of fecal coliform (GADNR 2020).

Criteria 3: Community-developed watershed plans are implemented to protect and monitor water and habitat quality in all occupied watersheds.

Status: Criteria partially met. Community action groups have worked along with state and federal agencies and city and county governments to help distribute information to the public and landowners, to conduct inventories and surveys, and to regulate actions that adversely affect water quality and quantity.

Cahaba River. In the Cahaba basin, the Nature Conservancy is engaging with stakeholders to develop a watershed plan for Shades Creek (Cahaba River Society 2019). Key issues in the watershed that will be considered are stream erosion, sedimentation, nutrients, land development, and stormwater runoff. Community-led action groups and non-profit organizations have published various watershed and specific reach management plans (e.g., Cahaba River Society 2019; City of Birmingham 2018; 2019; CNGRWP Council 2017; Friends of Shade Creek 2020)

Coosawattee River. In 2017, the Coosa-North Georgia Regional Water Plan was published, providing new funding opportunities to investigate and mitigate issues related to water quality in northwest Georgia, including Gilmer County. The Georgia Soil and Water Conservation Commission is working with local stakeholders and organizations in the Coosawattee River and Carters Lake watersheds to monitor impaired streams and identify sources of pollution. This information will help inform watershed management plans and best management practices (BMPs) (GSWCC 2020).

Although management plans for protecting water quality and quantity have been implemented, minimal quantitative improvement has been observed, especially with levels of siltation and sedimentation (ADEM 2019, Fix and Kuhajda 2019).

C. Updated Information and Current Species Status

1. Biology and Habitat

a. New information on the species' biology and life history: No new life history or biology studies have been conducted since the last 5-year review (USFWS 2015).

b. Abundance, population trends, demographic features, or demographic trends: There have been no systematic attempts to determine demographic features or demographic and population trends since the last 5-year review. Habitat suitability has been assessed in the upper Coosawattee River which can aid in targeted monitoring (Albanese 2014), but no such analysis has been conducted for the Cahaba River population. There continues to be a lack information or estimates of demographic parameters such as natality, mortality, sex and age ratios for either population. As described above, collections in both the Cahaba and Coosawattee suggest that populations in both systems could be stable.

c. Genetics: No new genetic studies have been conducted since the last 5-year review. However, any future propagation plans should consider the Cahaba River and Coosawattee River populations as separate management units based on the genetic divergence between them (Powers et al. 2015).

Prior genetic and occupancy analyses suggest the goldline darter's random mating population structure and clustered distribution may make it prone to source-sink dynamics and more susceptible to the effects of isolation (Albanese et al. 2014; Powers et al. 2015) or catastrophic events. If this species experiences source-sink population dynamics, river reaches with large populations act as sources that feed sink populations in tributaries. A single catastrophic event affecting a large source population also would imperil populations in marginal tributary habitats. Therefore, confirmation of the source-sink dynamics and subsequent identification and protection of source populations could be essential for the continued existence of this species.

d. Taxonomic classification or changes in nomenclature: None**.**

e. Distribution and trends in spatial distribution:
The goldline darter is endemic to the Alabama River basin and currently occurs in the upper Coosawattee River drainage of Georgia (HUC8: 03150102) and the Cahaba River drainage of Alabama (HUC8: 03150202; Fig 1). The spatially disjunct distribution of the goldline darter is likely the result of extirpation in the 300 river kilometers that separate the Alabama and Georgia populations (Powers et al. 2015).

In Georgia, the goldline darter occurs sporadically along 90.6 km of the Coosawattee watershed of the upper Coosa River drainage upstream of Carters Lake/re-regulation Reservoir, including portions of the Cartecay (34.9 km), Ellijay (23.4 km) and upper Coosawattee (14 km) rivers, Mountaintown Creek (18.32 km), and the lower portion of East Mountaintown Creek within Gilmer County (Fig 2).

A recent assessment of the species' conservation status and habitat use in Georgia found the species at a high proportion of sites (0.85) upstream of Carters Lake (Albanese 2014). However, Albanese (pers comm. 2014) estimated the species had lost 50.5 km or 33% of its total range in Georgia. The species has not been found in Talking Rock Creek (28.9 km) or the lower Coosawattee River (21.6 km) below Carters reservoir in Pickens, Gordon, and Murray counties since 1998, despite extensive surveys conducted during 2009-2011 (Albanese et al. 2014). We are considering these population in Talking Rock Creek and lower Coosawattee as likely extirpated since the species' listing.

In Alabama, goldline darters historically occupied approximately 78.9 km of the Cahaba River and 11.3 km of the Little Cahaba River (Suttkus and Ramsey 1967; Stiles 1978, 1990; USFWS 2000; Boschung and Mayden 2004; Fig 3). The species is expanding northward in the mainstem Cahaba River and further upstream along some of its tributaries and contracting along the southern extent of its range (Fix and Kuhajda 2019). In the past two decades, the goldline darter has existed sporadically along 94 km of the Cahaba River mainstem and four of its tributaries, including Schultz Creek (3.4 km upstream), Little Cahaba River (as far as 20 km upstream and the lower portions of

Sixmile Creek), Shades Creek (8.74 km upstream), and Buck Creek (2.73 km upstream).

Records in Schultz Creek and the Little Cahaba River date back to the 1960s, and the goldline darter was observed in both streams in 2019 (Fix and Kuhajda 2019). Monitoring conducted between 2007-2014 suggested the population may be expanding further upstream along Shades Creek. However, targeted monitoring efforts in 2018 detected goldline darter at just the furthest downstream of 11 sites sampled in Shades Creek. goldline darters were found in Buck Creek in 2018. Also, the species was recorded at two of eight sites of previously known occurrence sampled in the Cahaba River mainstem in 2018 with the southernmost being in Centreville, Bibb County, Alabama (Fix and Kuhajda 2019). Historical records suggest it once occupied lower portions of the Cahaba mainstem, south of its confluence with Haysop and Congo Creek, but individuals have not been collected here since 1996. It is unclear whether this trend is related to survey gaps or a change in its distribution.

f. Habitat and ecosystem conditions:

Goldline darters occupy medium-sized rivers and large tributary streams. Their preferred habitat comprises riffles and runs with swift current over gravel, cobble, bedrock and boulder substrate, often with patches of sand and riverweed (*Podostemum ceratophyllum*) (Freeman and Hagler 2009; Albanese et al., 2014). Benthic macrophytes like the American water-willow (*Justicia americana*) and riverweed that are components of high-quality shoal habitat have been declining over the past few decades (Argentina et al. 2010; Wood and Freeman 2017; Davis et al. 2018; Freeman and Freeman 2019). Modeling the distribution and status of suitable habitat throughout the goldline darter's range would aid in prioritizing preservation and restoration of its occupied and potential habitat. Models used to assess the current status of the species in Georgia suggest a high probability of suitable habitat within the mainstem upper Coosawattee River and large tributaries upstream of Carters Lake (Albanese et al. 2014). No such analysis has been conducted for the Cahaba River population, which occurs in the Ridge and Valley ecoregion of Alabama. Studies are needed to determine if habitat requirements of the species are equivalent between ecoregions and the extent of suitable habitat in the Cahaba River system.

g. Other:

Climate change is expected to bring more weather extremes, like flooding and drought, to the southeast (Mulholland et al., 1997). Changes in hydrologic flows may impact the availability and connectivity of shoal habitat, as well as spawning and recruitment success of goldline darters.

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

The purpose of a 5-Year Review is to recommend whether a listed taxon continues to warrant protection under the ESA and, if so, whether its status should be reclassified. This task requires that threats to the species be analyzed with the assumption that the species is not receiving the regulatory protections, funding, recognition, and other benefits of ESA listing. Summaries of ongoing applications of ESA protections may shed

light on some future activities that constitute threats to the species. However, the analysis under Factor D (Inadequacy of Existing Regulatory Mechanisms) focuses on the adequacy of existing alternative (i.e., non-ESA) mechanisms to address the continuing and foreseeable threats.

The 2015 5-year status review addresses the threats to goldline darter in both the Cahaba and the Coosawattee River systems (USFWS 2015). These threats all remain a concern for the species and are still acting to impact species viability. Below we address any further details or new threats related to species.

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

Cahaba and Little Cahaba River

The Cahaba River during high flows has very high fecal coliform concentrations in certain river segments (ADEM 2013b). Impacts from residential and infrastructure development continues to threaten water quality in the Little Cahaba (Gangloff 2017). Siltation and sedimentation continue to threaten the persistence of diverse fish assemblages in the Cahaba River (ADEM 2019).

Upper Coosawattee River

The species is threatened in Georgia by habitat loss and population fragmentation. Siltation is also an ongoing threat to the species and its habitat in the upper Coosawattee River, especially in the Ellijay River (Fix and Kuhajda 2019). Parts of the Ellijay River are negatively impacted by high fecal coliform loads from non-point pollution sources and urban runoff (GADNR 2020).

b. Overutilization for commercial, recreational, scientific, or educational purposes:
At the time of listing, overutilization was not deemed to be a likely threat to the goldline darter. We do not have any new information indicating that overutilization is a threat to this species.

c. Disease or predation:
Natural predation undoubtedly occurs within all sites for the goldline darter. However, there is no evidence to suggest that disease or natural predators threaten the species.

d. Inadequacy of existing regulatory mechanisms:
In the State of Alabama, the species is protected by Code of Alabama §§ 220-2-.92. In the State of Georgia, it is protected by Conservation Use Act of 1991 as amended (O.C.G.A 48-5-7.4), Endangered Wildlife Act of 1973 (O.C.G.A. 27-3-130), and others.

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); in Georgia, by the Erosion and Sedimentation Act of 1975 (O.C.G.A. 12-7-1); and Georgia Water Quality Control Act (O.C.G.A. 12-5-20). Alabama and Georgia follow traditional common-law riparian doctrine, which associates the right to use water with ownership of land abutting the water (Elliott 2011).

Due to inconsistency in the implementation of Clean Water Act, regulations, and other best management practices, which are voluntary for some activities and mandatory for

others, existing regulatory mechanisms in Alabama and Georgia are still inadequate to be protective of water quality in waters with goldline darters.

In Alabama, the goldline darter is offered some protection in the Cahaba River National Wildlife Refuge. In Georgia, the Chattahoochee National Forest (Powers 2008) and the Rich Mountain Wildlife Management Area protect some headwater streams. Municipal and county planning initiatives, like the Coosa-North Georgia Water Planning Council, also help protect some streams within the goldline darter's range.

In summary, regulatory mechanisms are in place to protect aquatic species, but the lack of specific information on the sensitivity of the species to common industrial and municipal pollutants limits the application of these regulations. Therefore, existing regulatory mechanisms, as currently applied, do not fully protect the species.

e. Other natural or manmade factors affecting its continued existence:
The existing populations of the goldline darter remain isolated due to fish passage barriers (e.g., dams, reservoirs, and stretches of unsuitable habitat), which render the species more susceptible to chronic stressors, stochastic events, and rapid environmental changes.

In Georgia, Carter's Dam creates Carters Lake (Fig. 2), which fragments habitat and blocks fish passage from the upper Coosawattee to potentially suitable habitat in the lower Coosawattee River (Albanese et al., 2014). Additionally, Carter's Reregulation Dam and Reservoir fragment the historical population in Talking Rock Creek from natural recolonization from the upper Coosawattee Rive populations. Furthermore, as recently as 2003, the U.S. Army Corps of Engineers regulated minimum flows without prioritizing the needs of aquatic biota, which could have negatively impacted goldline darter habitat and populations in the mainstem Coosawattee River downstream of Carters Dam. Other dams, reservoirs, culverts, and barriers to fish passage likely limit and isolate populations in tributaries of the Cahaba and upper Coosawattee River (Albanese et al., 2014).

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, Hunter 2002, Allendorf and Luikart 2007). The long-term viability of a species depends on the conservation of numerous local populations throughout its geographic range (Harris 1984). These separate populations are essential for the species to recover and adapt to environmental change (Harris 1984; Noss and Cooperrider 1994). The unnatural level of isolation of some populations of the goldline darter makes repopulation following localized extirpations virtually impossible without human intervention.

The goldline darter is will likely experience range shifts and fitness declines if water temperatures rise due to climate change. Water temperature exponentially affects the metabolic rate of aquatic species (Willmer et al. 2009), and increases in metabolic rate can lead to lower fitness through higher energy usage (Gosling 2008). Furthermore, climate change is expected to increase the frequency of floods and droughts

(Mulholland et al., 1997), which could increase erosion, sedimentation, isolation of populations, and stress on individuals and populations.

D. Synthesis

Goldline darters are currently restricted to small portions of the Cahaba River system and the upper Coosawattee Reiver. The species' clustered distribution and small population sizes makes it vulnerable to random natural or anthropogenic events that negatively impact habitat quality and quantity and fragmentation prevents natural recolonization of many reaches of river/stream after extirpation events. Protection and enhancement of water quality and quantity, especially during low flows and droughts, is necessary for the species' survival in both the Cahaba and upper Coosawattee rivers. Because of on-going threats throughout the species range, the species' limited distribution and isolation increasing risks of catastrophic events and genetic impairments, the goldline darter continues to meet the definition of a threatened species under the Act.

III. RESULTS

A. Recommended Classification:

No change needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Conduct high resolution genetic analyses to confirm or refute hypothesized source-sink population dynamics.
    - Identify source populations and implement protection plans targeting these populations.
    - Estimate effective population size.
- Establish long-term monitoring of the Cahaba and Coosawattee River basins.
- Develop a spatial model of suitable habitat for the species in the Cahaba River to direct surveys and prioritize management and restoration efforts.
- Collect demographic data required to conduct population viability analysis including age, sex, natality, and mortality of larval, juvenile, and adult life stages.
- Survey the Cahaba and upper Coosawattee river watersheds to identify and prioritize culverts and other fish passage barriers for removal.
- Use environmental DNA (eDNA) survey methods to identify habitats that may support the species in low abundances that make them hard to detect.
- Develop an updated species recovery plan to reflect new information and refine criteria.
- Support protection and restoration of riverine buffers on privately-owned lands, by forming relationships with landowners and working with conservation groups, local and state governments.
- Develop and implement best management practices for improving water quality and quantity, by reducing stormwater runoff, sediment loading, and eutrophication. Initiate cooperative agreement, conservation easement, fee title purchase or other means to guarantee safeguards to protect water quality. Of special concern are turbidity, water quantity, sedimentation, geomorphology, hydrology and other aspects of habitat quality that may impact the species.
- Implement new, and enforce existing, conservation, water quality, and land management laws and regulations that promote the improvement of habitat quality for the species.
- Develop a captive propagation plan for the species.

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Goldline Darter 5-Year Review Coosa River HUC 8 Watersheds (2021)

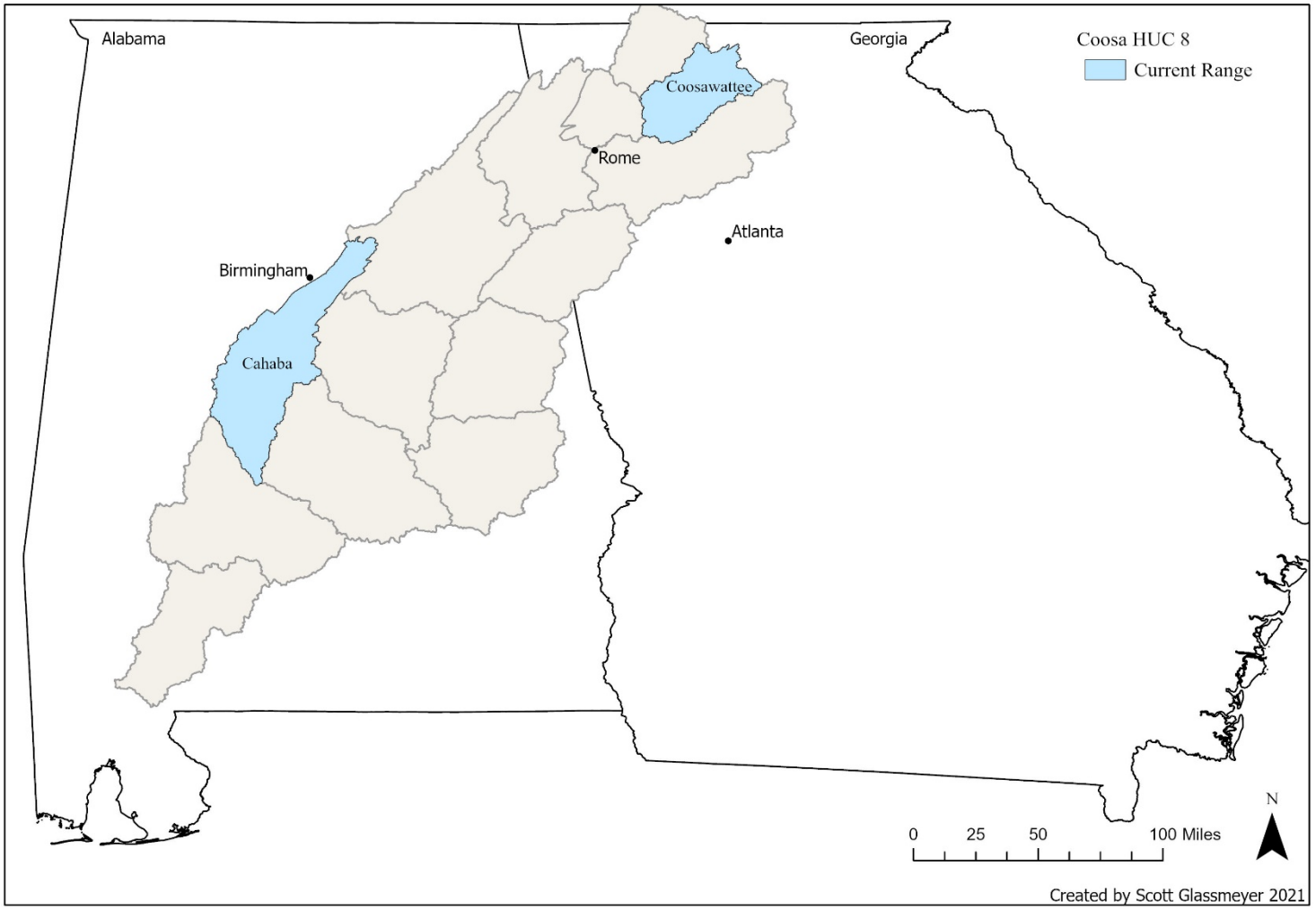

Figure 1. Cahaba (HUC8 ID: 3150202) and Coosawattee (HUC8 ID: 3150102) drainages known to support Goldline Darter populations in the Alabama and Georgia portions of the Alabama basin (HUC4: 315)

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Goldline Darter (*Percina aurolineata*)

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
__X__ No change needed

Review Conducted By: Scott Glassmeyer, Georgia Ecological Services Field Office.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve JOHN DORESKY Digitally signed by JOHN DORESKY Date: 2021.06.22 13:50:36 -04'00' Date _____

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