Slackwater Darter
(*Etheostoma boschungi*)

5-Year Status Review:
Summary and Evaluation

Slackwater darter, by Cal Johnson, Alabama Department of Environmental Management

U.S. Fish and Wildlife Service
Southeast Region
Alabama Ecological Services Field Office
Daphne, Alabama

February 2024

5-YEAR STATUS REVIEW

Slackwater Darter (*Etheostoma boschungi*)

GENERAL INFORMATION

Current Classification: Threatened

Lead Field Office: Alabama, Ecological Services Field Office: Jennifer Grunewald, 251-424-0635.

Reviewers: Alabama, Ecological Services Field Office: Scott Lamont, 251-441-5857.

Cooperating Field Office: Tennessee Ecological Services Field Office: Kerri Dikun, 931-525-4991.

Lead Regional Office: Atlanta Regional Office, Carrie Straight, (404) 679-7226.

Date of listing and Critical Habitat: October 11, 1977 (42 FR 45526, September 9, 1977).

Methodology used to complete the review: In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants (50 CFR 424.11). The U.S. Fish and Wildlife Service (Service) evaluated the biology, habitat, and threats of the slackwater darter (*Etheostoma boschungi*) to inform this status review.

We announced initiation of this review in the Federal Register on May 7, 2018 (83 FR 20092) with a 60-day comment period. The primary sources of information used in this analysis were the species' recovery plan (Service 1984), the most recent five-year review (Service 2008), recent studies of the species, peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. This review was completed by the Service's, Alabama Ecological Services Field Office (AFO), Daphne, Alabama. All literature and documents used for this review are on file at the AFO. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the slackwater darter.

FR Notice citation announcing the species is under active review:
May 7, 2018 (83 FR 20092)

Species' Recovery Priority Number at start of 5-year review (83 FR 20092**):** 8 *Etheostoma boschungi* is a species with a moderate degree of threat and a high recovery potential.

Review History:
Five-year Review: June 24, 2008 – No change in status was recommended.

REVIEW ANALYSIS

Taxonomy and nomenclature
We are not aware of any changes to the taxonomy of this entity, and the slackwater darter is still considered a valid species by the Service.

Distinct Population Segment (DPS):
The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This species was not listed as a DPS, and we have no new information that would indicate the species should be listed as a DPS under the Service's 1996 DPS Policy.

Recovery Criteria Recovery Plan

Slackwater darter (*Etheostoma boschungi*) Recovery Plan, March 8, 1984.

Recovery plans are not regulatory documents and are intended to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer requires protections under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act (84 FR 45020).

The recovery criteria (Service 1984) establishes that the slackwater dater could be considered for delisting when the following criteria are met:

> Criterion 1. Establishment and protection of one or more specific habitat areas (to be determined based on data from Tasks 1.1, 2.1, and 3) in at least three different tributaries to the Tennessee River where the slackwater darter is known to occur with specific spawning areas protected by purchase or cooperative agreement.
>
> Criterion 2. Data to indicate that the populations are stable or increasing in number.
>
> Criterion 3. Water quality and ecological data to indicate that the environment is suitable and stable or improving.

The Service believes these criteria are appropriate and relevant; however, no criteria have currently been met.

Biology and Habitat Summary

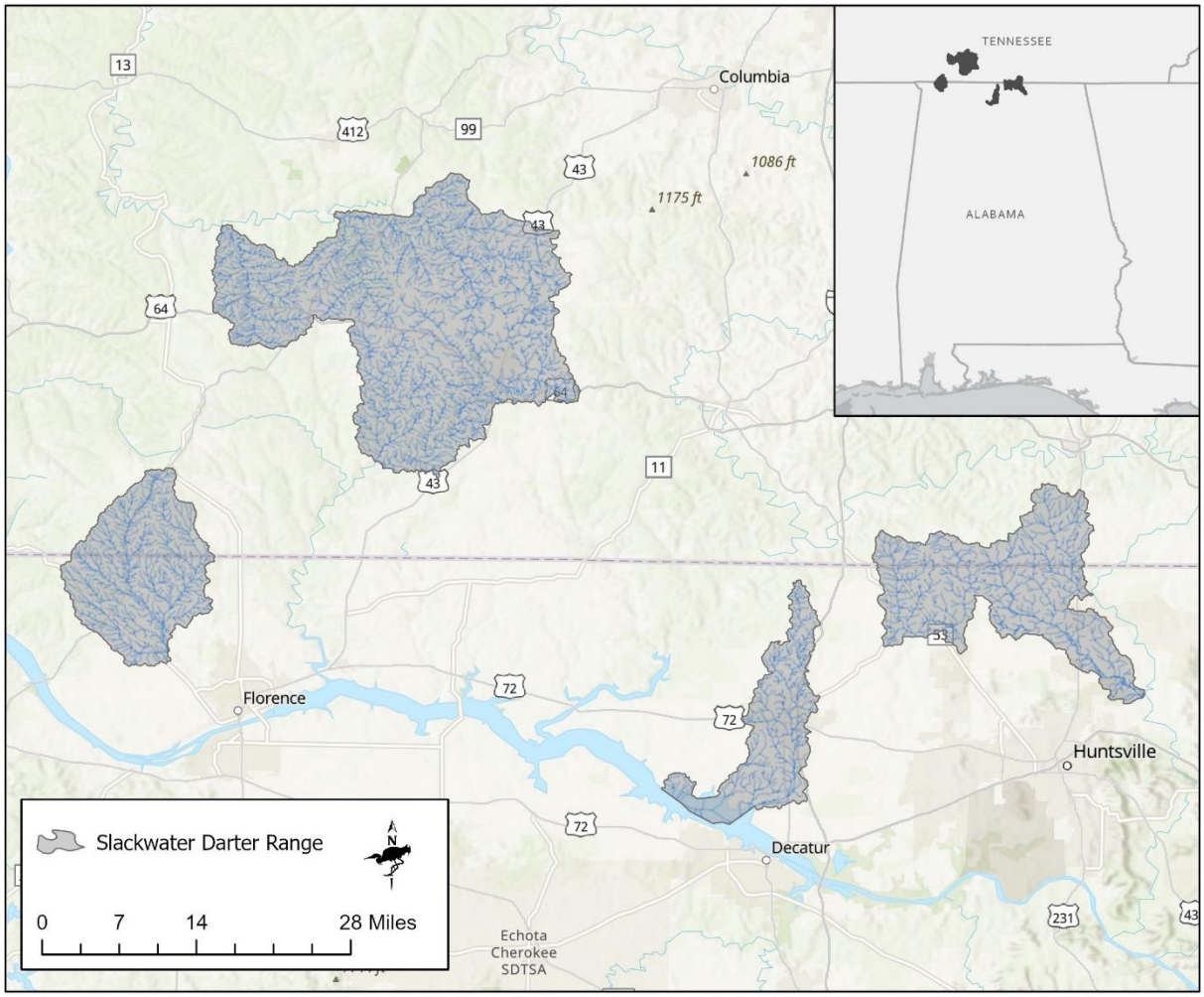

Figure 1. Current Range of the slackwater darter.

A detailed review of the species' biology and habitat information can be found in the previous 5-year status review of this species (Service 2008).

The slackwater darter occurs in two required habitat types: nonbreeding habitat and breeding habitat (Service 1984). For the-majority-of the year, they live in small (60 cm wide to 15 cm deep) to moderately large (12 m wide and up to 2 m deep) gravel-bottomed pools of creeks where current is usually slow (Wall and Williams, 1974; Boschung, 1976, McGregor and Shepard, 1995). As the name suggests, slackwater darters prefer streams with slow current or "slack" water. In November, slackwater darters migrate to their breeding habitat. The breeding habitat is shallow water (5 to 10 cm deep), which originates in spring seeps, spring boils, or flooded fields that slowly run off into adjacent streams. In April to early May, juveniles migrate to the non-breeding habitat. Slackwater darter populations are entirely dependent upon connectivity between these two habitat types for successful recruitment (Boschung 1976, 1979).

Populations

The slackwater darter occurs in five systems of the middle Tennessee River: Cypress Creek watershed (Lauderdale Co., AL and Wayne Co., TN); Swan Creek watershed (Limestone Co., AL); Flint River watershed (Madison Co., AL and Lincoln Co., TN); Shoal Creek watershed (Lawrence Co., TN; and Buffalo River watershed (Lawrence Co., TN). Survey efforts in 2022 by the Service and Alabama Department of Environmental Management collected slackwater darters at three locations, two sites in Alabama and one in Tennessee in the Cypress Creek population. The Alabama sites in Limestone County and Lauderdale County are currently the only confirmed spawning locations of this species in the state (Hurt pers. comm. 2023).

In a study conducted to compare historical records of slackwater darter presence in the 1970s to more recent survey data collected in the 1990s and 2000s, comparisons suggest the species is suffering a decline in both distribution and abundance (Johnston et al. 2013) (Table 1). Survey results during this timeframe suggest an approximate 45% reduction in slackwater darter range (Johnston et al. 2013). Though negative collections did occur at sites that were previously occupied, five new sites (2 breeding and 3 non-breeding) were discovered during the study. The decline in distribution and abundance makes monitoring of this species difficult and during the study, numerous samples were necessary for the detection of slackwater darter, suggesting low numbers of individuals are present relative to historical samples (Johnston et al. 2013). Additionally, Janosik and Johnston obtained eDNA hits at some historical sites in 2015. While follow-up would be needed to confirm presence, the eDNA hits may suggest the species persists at other locations.

Table 1. Number of slackwater darter fish collected during corresponding years.

Darter collections over time	**2001**	**2002**	**2006**	**2007**	**2012**	**2013**	**2022**
	109	40	21	25	6	5	6

Survey results in 2013 compared to results in 2022 suggest population decline may be stabilizing, but this is difficult to accurately determine for certain because the 2022 survey effort only included Cypress Creek. Since previous surveys included multiple watersheds over the known distribution, additional surveys are needed to better determine population data at the present time. Slackwater darter populations are also under threat due to habitat decline concerns. Roy et al. reported in 2019 that of the 176,566 acres of land encompassing slackwater darter known distribution, 29,902 acres of the occupied area is considered to be “at greatest risk” (Roy et al. 2019). “At risk” land can be attributed to current and on-going development and encroachment on- slackwater darter habitat from human activities with the majority of “at risk” locations being clustered around slackwater darter populations in the Cypress Creek and Flint River systems (Roy et al. 2019).

Threats (Five-Factor Analysis) Summary

A detailed review of the species’ biology and habitat information can be found in the previous 5-year

status review of this species (Service 2008). The status of a species is determined from an assessment of factors specified in section 4(a)(1) of the Act.

Factor A: the present or threatened destruction, modification, or curtailment of its habitat or range.

The primary threat to the slackwater darter is habitat degradation resulting in a decline in water quality (Service 2008). Urbanization and development are potential threats to the physical integrity of slackwater darter habitat. Stormwater management and drainage improvements associated with development in areas with shallow groundwater also pose a threat to this species. Additionally, slackwater darters may be impacted by passage barriers, such as culverts and loss of connectivity to breeding sites due to channel incision (Johnston et al. 2013). Data on bank height ratios suggest a low ratio (<2), and which more likely allows a connection between the stream and floodplain, equates to extant populations of the slackwater darter, while higher ratios (2.3-8.4) result in areas where populations have not been detected likely a result of reduction in available slack water habitat (Johnston et al. 2013). A habitat risk assessment and habitat suitable model were performed (Roy et al. 2019) in the range of the darter. The 'best-suited' habitat based on the model occurs in the Swan Creek, Flint River, and Cypress Creek watersheds. Agricultural land was identified to be related to suitable habitat, indicating that important slackwater darter habitat exists alongside human-influenced land use types.

Degradation of surface and groundwater caused by the intrusion of toxins, pesticides, herbicides, fertilizers, as well as industrial and domestic wastes from sewage/septic tank seepage, and stockyard runoff are current threats to the slackwater darter by reducing their survival and reproductive capacity. Farming and cattle are the principal industries surrounding the darter's habitat, increasing indirect habitat modifications through organic run-off and chemical run-off from surrounding land use practices. Since the breeding habitats are so limited, even a small chemical spill or biological pollutant could completely exterminate a breeding population.

Factor B: overutilization for commercial, recreational, scientific, or educational purposes.
We have no evidence that overutilization for commercial, recreational, scientific, or educational purposes are currently a threat to the species. Scientific collecting, which has not involved lethal take, is controlled by the State of Alabama.

Factor C: disease or predation.
While predation occurs, there is no evidence to suggest that disease and predation pose a threat to the species at-this-time. Two species of fish known to feed on slackwater darters are: *Lepomis cyanellus* and *Aphredoderus sayanus*.

Factor D: the inadequacy of existing regulatory mechanisms.
The slackwater darter and its habitats are afforded some protection through state laws and the Clean Water Act of 1972 (33 U.S.C. 1251 et seq). Code of Alabama §§ 220-2-92, makes it unlawful to take or attempt to take, capture, or kill the slackwater darter. Under the Tennessee Nongame and Endangered or Threatened Species Conservation Act of 1974 (Tennessee Code Annotated §§ 70-8-101-112), "…it is unlawful for any person to take, attempt to take, possess,

transport, export, sell or offer for sale or ship nongame wildlife…it is also unlawful for any common or contract carrier knowingly to transport or receive for shipment nongame wildlife." The species is also 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 Tennessee's Water Quality Control Act of 1977 (T.C.A. 69-3-101). Although these laws offer some protection, declines in distribution and abundance of the species across its range demonstrate that existing regulatory mechanisms in Alabama and Tennessee, are still inadequate to fully protect this species from the ongoing threats.

Factor E: other natural or manmade factors affecting its continued existence.

Slackwater darter breeding habitats are found in locations that would be ideal sites for fish farm ponds. Much of the year the sites are too wet to plow, and as a pasture they abound in Juncus and Eleocharis, not the most desirable forage (Service 1984). Farm pond density and land cover types have been identified as potential drivers of decline and or extirpation of the slackwater darter (Roy et al. 2019).

Climate change on temperature and flow rates/flood cycles could also be a concern. Although temperatures have generally been unchanged since the start of the 1900s, 2016-2020 was the warmest consecutive 5-year interval on record (Runkle et al. 2022a). Unlike many other states in the southeast, recent documented temperatures are below those seen in the 1920s and 1930s; however, average annual temperatures are projected to rise and exceed historical levels (Runkle et al. 2022a,b). With predicted increases in temperature, there will likely also be associated increases in intensity of drought periods (Runkle et al. 2022a,b) which could have an impact on slackwater darter habitat, especially breeding habitat. Future models also predict a potential for increased extreme precipitation events in Tennessee (Runkle et al. 2022b). Extreme events could result in incising streams, scouring habitat and removing slack water habitat and result in additions of organic and toxic materials in the waterways. These changes in temperature, drought, and precipitation could therefore have negative impacts on water quality and quantity and the timing and availability of appropriate habitat and also have impacts on reproductive success.

Synthesis

The slackwater darter is threatened species found in five watersheds of the middle Tennessee River. Continued and on-going threats to this species from development, the species' small population size, and a limited distribution contribute to its vulnerability. Data collected since the 1970's has demonstrated a distributional decline, but there have been additional discoveries at new locations. Land use/land cover and farm pond density have been identified as potential factors of slackwater darter extirpation and road crossings, presenting a fish passage barrier, have also been identified as potential catalysts for population declines. Because of these threats and limited distribution, the slackwater darter continues to meet the definition of a threatened species under the Act.

RECOMMENDED FUTURE ACTIVITIES

A detailed discussion of recovery actions and criteria are presented in the Recovery Plan (Service 1984). During the course of this status review new and/or targeted potential recovery activities were identified and are included below.

Recovery Activities

- Establishment and protection of one or more specific habitat areas (to be determined based on data from Tasks 1.1, 2.1, and 3) in at least three different tributaries to the Tennessee River System where the slackwater darter is known to occur with specific spawning areas to be protected by purchase or cooperative agreement.

Monitoring and Research Activities

- Population monitoring should be conducted to assess the response of the slackwater darter to continued threats, determine the current population size, and determine location occurrences of this species.

    - Data to indicate population condition.
    - Water quality and ecological data to indicate habitat suitability.
    - Conduct winter and early spring census near and in known breeding habitats (Task 1.1 in Recovery Plan).

- Study assembly, migration and migration routes (Task 2.1 in Recovery Plan).
- Locate breeding habitats for populations in the Buffalo River, Flint River, Shoal Creek, and Swan Creek (Task 3 in Recovery Plan).
- Continue the use of eDNA to determine potential presence of the slackwater darter in known and potentially new sites. Follow up fish surveys should be performed to determine occupancy.
- Perform assessments at road/stream crossings in the species' range to determine if instream barriers exist that hinder slackwater darter migration. Where feasible, make passage improvements at priority road/stream crossings.

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Robert Hurt, USFWS. 2023. Re: Slackwater Darter ?

RESULTS / SIGNATURES

U.S. Fish and Wildlife Service
Status Review of Slackwater Darter (Etheostoma boschungi)

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

_____Downlist to Threatened
_____Delist:
_____*The species is extinct*
_____*The species does not meet the definition of an endangered or threatened species*
_____*The listed entity does not meet the statutory definition of a species*
_X_ No change needed

FIELD OFFICE APPROVAL:

Field Supervisor, Alabama Ecological Services Field Office, Fish and Wildlife Service

Approval: WILLIAM PEARSON Digitally signed by WILLIAM PEARSON Date: 2024.03.21 15:03:52 -05'00'