Cumberland Darter
(*Etheostoma susanae*)

5-Year Status Review:
Summary and Evaluation

Photo courtesy of J.R. Shute, Conservation Fisheries, Inc.

U.S. Fish and Wildlife Service
Southeast Region
Kentucky Ecological Services Field Office
Frankfort, Kentucky

July 2024

STATUS REVIEW
Cumberland Darter (*Etheostoma susanae*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Kentucky Ecological Services Field Office, Frankfort, Kentucky; Dr. Michael A. Floyd

Review Author(s): Dr. Michael A. Floyd, Kentucky Ecological Services Field Office

Reviewers:
Lead Regional Office: Atlanta Regional Office, Carrie Straight

Cooperating Field Office: Tennessee Ecological Services Field Office, Kerri Dikun

Date of original listing/4(d) rule: September 8, 2011 (76 FR 48722; August 9, 2011)

Critical habitat final rule: November 15, 2012 (77 FR 63603; October 16, 2012)

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). In conducting this 5-year review, the U.S. Fish and Wildlife Service (Service) relied on the best available information pertaining to historical and current distributions, life history, ecology, and habitat of this species. We announced initiation of this review in the Federal Register on May 11 23, 2023 (88 FR 30324), with a 60-day comment period and received two public comments. The National Council for Air and Stream Improvement (NCASI) provided information regarding the use and effectiveness of forestry best management practices and their importance in protecting aquatic species and stream habitats in the United States. We have noted best management practices in the review. A second commenter expressed concerns over logging practices on the Daniel Boone National Forest in Whitley County, Kentucky, and the potential for these actions to adversely affect habitats occupied by the Cumberland darter. We share the commenter's concern regarding the potential for forestry practices to adversely affect Cumberland darter habitats, and we discuss these potential stressors in this review. The primary sources of information used in this analysis were the 2011 final listing rule (81 FR 68963), the 2018 five-year review (Service 2018), agency reports, and unpublished survey data and reports. This review was completed by the U.S. Fish and Wildlife Service, Kentucky Ecological Services Field Office, Frankfort, Kentucky. All literature and documents used for this review are on file at the Field Office. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the Cumberland darter.

FR Notice citation announcing the species is under active review: May 11, 2023 (88 FR 30324)

Species' Recovery Priority Number at start of 5-year review (48 FR 43098): 5. The Cumberland darter is a species with a high degree of threat and a low recovery potential.

Review History:
This is the second 5-year status review for this species. The first 5-year status review was completed in 2018 (Service 2018).

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature
The taxon is still considered a valid entity by the Service. The currently accepted classification for the Cumberland darter is *Etheostoma susanae* (Jordan and Swain).

Distinct Population Segment (DPS) (61 FR 4722)
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. No DPS for this species has been listed, and we have no new information that a DPS for this species should be considered and then listed pursuant to the Services' 1996 DPS Policy.

Recovery Criteria

Recovery Plan or Outline
A final recovery plan was completed for the species on May 2, 2019 (Service 2019).

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). Below are the delisting (recovery) criteria identified in the 2019 recovery plan (Service 2019).

1. Management Units 1-9 or Management Units 1-7, 9, and one additional stream within the species' historical range (e.g., Sanders Creek) are determined to be protected from present and foreseeable habitat threats through recovery efforts like land acquisition, conservation agreements and easements, stewardship, habitat restoration, outreach, adequate regulatory oversight, and enforcement, or other similar actions[1];
2. Instream habitat quality (substrate, flows, water quality) in these management units is sufficient, as defined by recovery tasks 3.1 and 3.2, to meet the species' life history requirements; and

[1] Conservation of these management units would increase the species' resiliency, redundancy, and representation, thereby reducing the threat of extinction from stochastic and catastrophic events and changing environmental conditions.

3. A viable population[2] must occur within each of these management units.

Biology and Habitat Summary

Habitat

The Cumberland Darter inhabits pools or shallow runs of low to moderate gradient sections of streams with sand, silt, or sand-covered bedrock substrates (O'Bara 1988, O'Bara 1991, Thomas 2007). Thomas (2007) did not encounter the species in high-gradient sections of streams or areas dominated by cobble or boulder substrates. Thomas (2007) reported that streams inhabited by Cumberland Darters were second- to fourth-order, with stream widths ranging from 4 to 9 meters (m) (11 to 30 feet [ft]) and depths ranging from 20 to 76 cm (8 to 30 in). Most of these habitats contain isolated boulders and large cobble that the species likely uses as cover.

Diet

Feeding habits of the Cumberland darter are unknown but are likely similar to the Johnny darter (*E. nigrum*), a diurnal sight feeder. According to Etnier and Starnes (1993), Johnny darters prey on midge larvae, mayfly nymphs, caddisfly larvae, and microcrustaceans. Like other darters, juvenile Cumberland Darters likely feed on planktonic organisms or other small invertebrates.

Reproduction and Life History

A detailed life history study for the Cumberland Darter has not been conducted. The species' spawning period likely extends from April to June based on observations by Thomas (2007) and available information for its closest relative, the Johnny Darter. Thomas (2007) reported the collection of nuptial males in April and May, with water temperatures ranging from 15 to 18 degrees Celsius (°C) (59 to 64 degrees Fahrenheit (°F)). Extensive searches by Thomas (2007) produced no evidence of nests or eggs at these sites. Reproductive habits of the Johnny darter have been well studied by Winn (1958a), Winn (1958b), Speare (1965), and Bart and Page (1991). Spawning occurs from April to June, with males migrating to spawning areas prior to females and establishing territories at selected spawning sites. Males establish a nest under a submerged object (boulder, woody debris) by using fin movements to remove silt and debris. Females enter the nests, the spawning pair inverts, and females deposit between 40 and 200 adhesive eggs on the underside of the nest object. Males care for the nest by periodically fanning the area to remove silt. The eggs hatch in about 6 to 16 days, depending on water temperature. Hatchlings are about 5 mm (0.2 in) and reach 29 to 38 mm (1.1-1.5 in) at age 1. Three age classes have been noted in some collections, indicating that Cumberland Darters live as long as three years (Thomas 2016, pers. comm.).

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[2] Populations will be considered viable when the following demographic and genetic conditions exist:

1. Demographics – monitoring data demonstrate the following:
   a. Populations are stable or increasing over a period encompassing 5 generations (i.e., 15 years),
   b. Two or more age-classes are consistently present within that same period, and
   c. Evidence of recruitment is lacking in three or fewer years and in no more than two consecutive years at any point within that period.
2. Genetics – measurements of observed number of alleles and estimates of heterozygosity and effective population size have remained stable or increased during the five generations used to establish demographic viability.

Genetics

Kuhajda *et al*. (2020) completed the only population genetics study for the Cumberland darter. The study used mitochondrial DNA (DNA located in the cell's mitochondria) to evaluate genealogical relationships and diversity of populations and to determine phylogenetic relationships between the Cumberland darter and populations of the Johnny darter (*E. nigrum*) in the upper Cumberland River drainage. They also used microsatellite DNA (a short segment of DNA that is repeated multiple times, occurs throughout the genome, and varies from one individual to another) to evaluate contemporary genetic structure and diversity of Cumberland darter populations. Results of mitochondrial DNA analyses demonstrated that Cumberland darter and Johnny darter populations were distinct lineages, with no apparent introgression (transfer of genetic information from one species to another due to hybridization). Except for Youngs Creek, Cumberland darter populations also exhibited low haplotype diversity (a haplotype is a set of DNA variants along a single chromosome that tend to be inherited together). Results of microsatellite analyses showed that (1) Cumberland and Johnny darters were distinct lineages with no introgression, and (2) the Cumberland darter was genetically structured into seven distinct populations. These results indicated that each separate stream system supporting Cumberland Darter populations were unique genetically and were isolated from all other populations, except for two widely separated streams, Wolf Creek and Laurel Fork, which formed a distinct genetic cluster. With the exception of Wolf Creek and Laurel Fork, these genetic clusters align with the species' management units (Figure 1) (Service 2019).

Distribution

Based on all survey information available to the Service (Thomas 2007; Yates 2017; Carter 2018, pers. comm.; Thomas and Brandt 2022; Service unpublished data), the species' current distribution is limited to 17 stream segments in Kentucky (McCreary and Whitley counties) and Tennessee (Campbell and Scott counties) (Figure 1; Appendix A). These streams are clustered in nine, isolated stream systems (Bunches Creek, Youngs Creek, Laurel Fork (of Indian Creek), Cogur Fork, Indian Creek, Laurel Creek, Jellico Creek, Wolf Creek, and Laurel Fork (of Clear Fork), which are separated geographically by an average distance of 30.5 stream km (19 mi) (Figure 1) (O'Bara 1988, O'Bara 1991, Thomas 2007). These stream systems correspond to nine proposed management units identified in the species' 2019 recovery plan (Service 2019). The Cumberland Darter is now extirpated from seven historical streams: Brier Creek, Cal Creek, Gum Fork, Little Wolf Creek, Marsh Creek, Sanders Creek, and Watts Creek (Thomas 2007; Yates 2017; Service unpublished data).

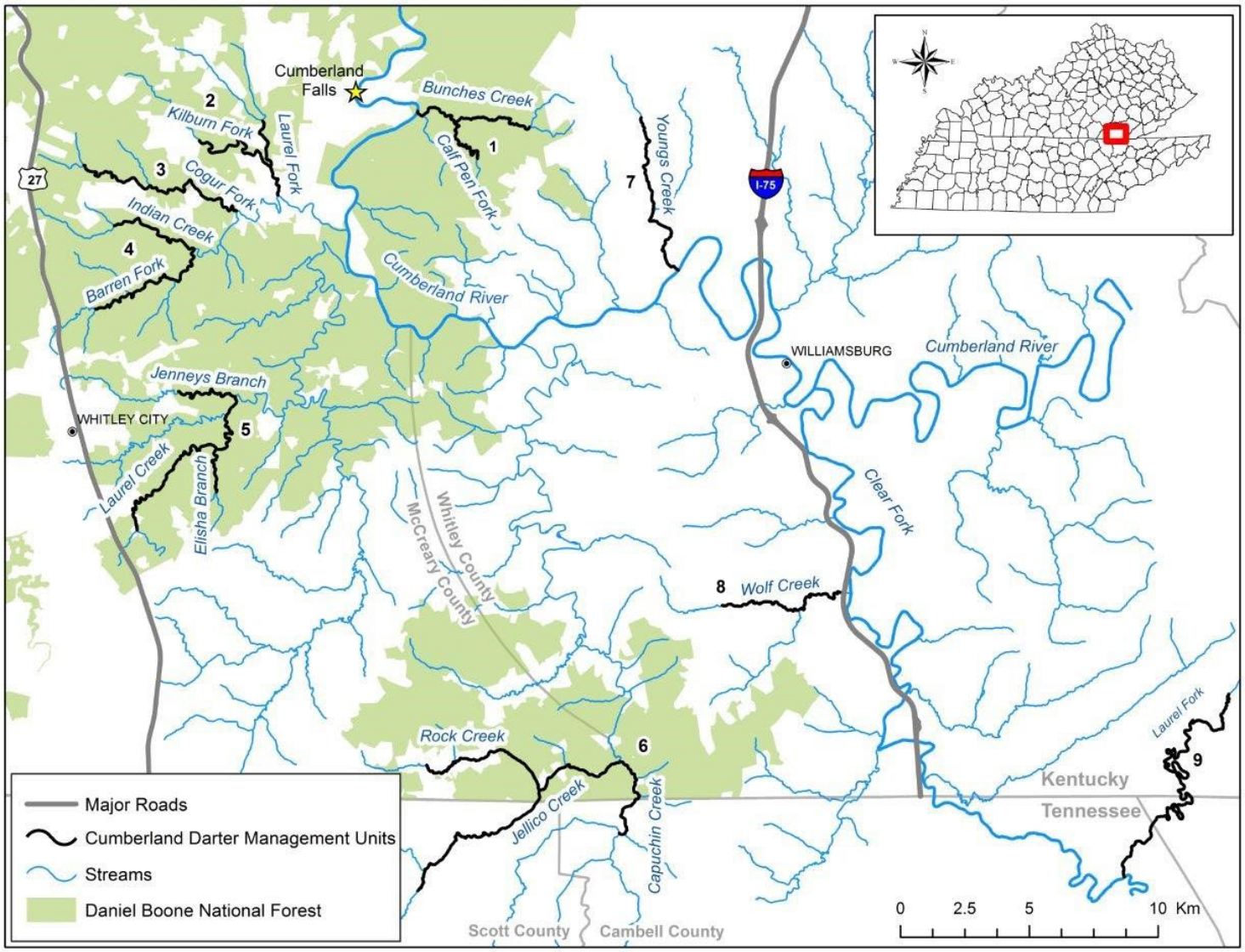

Figure 1. Cumberland darter distribution in Kentucky and Tennessee.

Threats (Five-Factor Analysis) Summary

As specified in section 4 (a)(1) of the Act, a species' status must be determined through consideration of the following five factors:

A. present or threatened destruction, modification, or curtailment of its habitat or range;
B. over-utilization of the species for commercial, recreational, scientific, or educational purposes;
C. disease or predation;
D. inadequacy of existing regulatory mechanisms; and
E. other natural or manmade factors affecting its continued existence.

Factor A continues to be the primary threat for the Cumberland darter. The primary stressors associated with this factor are siltation (excess sediments suspended or deposited in a stream), and channel disturbance associated with surface coal mining, logging, agriculture, road construction and maintenance, and other human development activities in the upper Cumberland River drainage (Waters 1995; Pond 2004; Thomas 2007; Kentucky Division of Water (KDOW) 2015, 2018a, 2018b, 2022). Siltation can affect fishes through abrasion of gill tissues, suffocation of eggs or larvae, reductions in disease tolerance, degradation of spawning habitats, modification of migration patterns, and reductions in food availability (Berkman and Rabeni 1987, Waters 1995, Wood and Armitage 1997, Meyer and Sutherland 2005).

Unintentional collection by anglers (for use as bait) may occur in some portions of the species' range; however, overutilization of the species for commercial, recreational, scientific, or educational purposes (Factor B) is not considered to be a significant threat. The species is undoubtedly consumed by predators such as herons and sunfishes (Factor C), but we consider this to be a normal aspect of the species' population dynamics. The species is also not known to be threatened significantly by any disease (Factor C).

Existing regulatory mechanisms (Factor D) have provided for some improvements in water quality and habitat conditions in the upper Cumberland River drainage, but existing regulatory mechanisms have been inadequate in fully protecting streams inhabited by the species. Sedimentation and non-point source pollutants continue to represent an imminent threat of low to moderate magnitude across the species' range. Further, the information available to us at this time does not indicate that the magnitude or imminence of this threat is likely to be appreciably reduced in the foreseeable future.

The species' fragmented distribution and the disjunct nature of many of its populations (Factor E) has reduced its contemporary gene flow (Kuhajda *et al*. 2020). This restricts the natural interchange of genetic material between populations and makes natural repopulation following localized extirpations virtually impossible without human intervention. The small size and low genetic diversity of Cumberland darter populations also makes them vulnerable to extirpation from toxic chemical spills, habitat modification, progressive degradation from runoff (non-point source pollutants), natural catastrophic changes to their habitat (*e.g*., flood scour, drought), and other stochastic disturbances. The information available to us at this time does not indicate that the magnitude or imminence of this threat is likely to be appreciably reduced in the foreseeable future.

Synthesis

The Cumberland darter is a small benthic fish that typically occupies bedrock pools and shallow runs in second- to fourth-order streams of the upper Cumberland River drainage in Kentucky (McCreary and Whitley counties) and Tennessee (Campbell and Scott counties). No population estimates or status trends are available for the species; however, surveys indicate the species has been extirpated from seven historical streams, and remaining populations occupy short stream reaches and occur in low densities. The Cumberland darter's current distribution is limited to 17 streams that are clustered in nine watersheds that are effectively isolated from each other - Bunches Creek, Youngs Creek, Laurel Fork (of Indian Creek), Cogur Fork, Indian Creek, Laurel Creek, Jellico Creek, Wolf Creek, and Laurel Fork (of Clear Fork).
Cumberland darter habitats continue to be adversely affected by siltation and channel disturbance associated with logging, agriculture, surface coal mining, road construction and maintenance, and other human development activities in the upper Cumberland River drainage. Current regulatory mechanisms, such as the Federal Clean Water Act, have contributed to some improvements in water quality and habitat conditions, especially on public lands; however, these mechanisms have been inadequate in fully protecting the Cumberland darter and its habitats. The species' fragmented distribution, lack of gene flow, and low genetic diversity increases its vulnerability to extirpation from chemical spills, habitat disturbance, catastrophic weather events (drought, floods), and a variety of other stochastic disturbances. Because of its restricted distribution and continued vulnerability to these threats, and our uncertainty regarding the viability of individual populations across the range, we believe that the species continues to meet the definition of an endangered species and it should remain classified as endangered.

RECOMMENDED FUTURE ACTIVITIES

We have identified the following recovery, monitoring, and research activities:

Recovery Activities

- Continue to utilize existing legislation and regulations to protect the species and its habitats (*e.g.*, Act, federal and state surface mining laws, Clean Water Act, state water quality regulations).
- Continue to protect, restore, and enhance habitat quality across the species' range. 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.

Monitoring and Research Activities

- Conduct quantitative surveys in each occupied stream to estimate population size.
- 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 (*e.g.*, sedimentation). Using this information, determine what management strategies are needed to improve the species' status across its range.
- Continue research on population genetics; evaluate gene flow and genetic diversity across the species' range.

- Conduct a life history study for the species.
- Evaluate the potential for reintroduction of the species into historical habitats. Assess habitat and water quality conditions in these streams and determine which streams are suitable for reintroduction efforts.

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RESULTS / SIGNATURES

U.S. Fish and Wildlife Service
Status Review of Cumberland darter

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.

____ Uplist to Endangered
____ 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, Kentucky Ecological Services Field Office, Fish and Wildlife Service

Approve VIRGIL ANDREWS Digitally signed by VIRGIL ANDREWS Date: 2024.07.03 16:47:20 -04'00'

APPENDIX A: Summary of Cumberland Darter (*Etheostoma susanae)* status in all historical streams

Table A-1. Summary of Cumberland Darter status in all streams of historical occurrence in the upper Cumberland River drainage, McCreary and Whitley counties, Kentucky, and Campbell and Scott counties, Tennessee (Thomas 2007, Kuhajda *et al*. 2020, Service unpublished data).

Sub-Basin	Stream	State	County	Current Status	Date of Last Observation
Bunches Creek	Bunches Creek	KY	Whitley	Extant	2018
Bunches Creek	Calf Pen Fork	KY	Whitley	Extant	2006
Sanders Creek	Sanders Creek	KY	Whitley	Extirpated	1985
Youngs Creek	Youngs Creek	KY	Whitley	Extant	2017
Indian Creek	Barren Fork	KY	McCreary	Extant	2017
Indian Creek	Cogur Fork	KY	McCreary	Extant	2022
Indian Creek	Laurel Fork	KY	McCreary	Extant	2017
Indian Creek	Kilburn Fork	KY	McCreary	Extant	2017
Marsh Creek	Bridge Fork	KY	McCreary	Extant	2017
Marsh Creek	Cal Creek	KY	McCreary	Extirpated	1996
Marsh Creek	Elisha Branch	KY	McCreary	Extant	2007
Marsh Creek	Jenneys Branch	KY	McCreary	Extant	2007
Marsh Creek	Laurel Creek	KY	McCreary	Extant	2007
Marsh Creek	Marsh Creek	KY	McCreary	Extirpated	1985
Jellico Creek	Capuchin Creek	KY, TN	McCreary, Campbell	Extant	2012
Jellico Creek	Hatfield Creek	TN	Campbell	Extant	2018
Jellico Creek	Gum Fork	TN	Scott	Extirpated	1940
Jellico Creek	Jellico Creek	KY, TN	Whitley, Scott	Extant	2012
Jellico Creek	Rock Creek	KY	Whitley	Extant	2017
Clear Fork	Brier Creek	KY	Whitley	Extirpated	1985
Clear Fork	Laurel Fork	KY, TN	Whitley	Extant	2017
Clear Fork	Little Wolf Creek	KY	Whitley	Extirpated	1947
Clear Fork	Watts Creek	KY	Whitley	Extirpated	1981
Clear Fork	Wolf Creek	KY	Whitley	Extant	2017