Technical / Agency Draft Recovery Plan
For the
Cumberland Darter (*Etheostoma susanae*)

Photo courtesy of Dr. Matthew Thomas,
KY Department of Fish and Wildlife Resources

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For:
U.S. Fish and Wildlife Service
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October 2017

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Suggested citation:

U.S. Fish and Wildlife Service. 2017. Technical/Agency Draft Recovery Plan for the Cumberland Darter (*Etheostoma susanae*). Atlanta, Georgia. 9 pp.

Draft Recovery Plan for
Cumberland Darter (*Etheostoma susanae*)

This Recovery Plan describes criteria for determining when the Cumberland Darter should be considered for delisting, lists site-specific actions that will be necessary to meet those criteria, and estimates the time required and costs for implementing recovery actions necessary to get to recovery. Additionally, cursory information on the species' biology and status are included, along with a brief discussion of factors limiting its populations. A Species Biological Report, which provides a more detailed account of the species status, distribution, biology, and threats, and a Recovery Implementation Strategy, which describes the activities to implement the recovery actions, is available at www.fws.gov/frankfort/. The Recovery Implementation Strategy and Species Biological Report will be updated on a routine basis

Species' Status: The Cumberland Darter was federally listed as endangered on August 9, 2011 (76 FR 48722). The species' recovery priority number is 5, indicating a low recovery potential and a high degree of threat (48 FR 43098). The recovery potential is considered low because habitats within the majority of the species' historical range have been altered physically and chemically, restoration of these habitats will be difficult, and the species' populations are isolated geographically (refer to Species Biological Report, Figure 1). We designated approximately 86 river km (54 river miles) in 15 streams as critical habitat for the Cumberland Darter on October 16, 2012 (77 FR 63604) (refer to Species Biological Report, Figure 2). Critical habitat is located in McCreary and Whitley Counties, Kentucky, and Campbell and Scott Counties, Tennessee. The Cumberland Darter is ranked by the Kentucky State Nature Preserves Commission (KSNPC) (2009) and the Tennessee Department of Environment and Conservation (TDEC) (TDEC 2009) as a G1G2S1 species: critically imperiled or imperiled globally and critically imperiled in Kentucky and Tennessee. The species was identified as a species of Greatest Conservation Need (GCN) in Kentucky's State Wildlife Action Plan (KDFWR 2013) and a Tier 1 GCN in Tennessee's Comprehensive Wildlife Conservation Strategy (CWCS) (TWRA 2005).

Habitat Requirements and Limiting Factors: 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.

The Cumberland Darter is threatened primarily by factors associated with the destruction, modification, or curtailment of its habitat or range. Threats include a variety of human-induced impacts such as sedimentation, disturbance of riparian corridors, and changes in channel morphology (Waters 1995, Thomas 2007). The most significant of these impacts is siltation (excess sediments suspended or deposited in a stream) caused by excessive releases of sediment from activities such as resource extraction (e.g., coal mining, logging, natural gas development), agriculture, road construction, and urban development (Waters 1995; Kentucky Division of Water (KDOW) 2006, 2008, 2010; Thomas 2007). Inadequate regulatory mechanisms and the

species' limited geographic range and small population size have also been identified as threats. Climate change is likely to adversely affect the species due to alteration of hydrologic cycles of headwater streams, but the extent or magnitude of this threat has not been quantified at this time.

Recovery Strategy: The primary strategy for recovery of the Cumberland Darter is to ensure that viable populations exist throughout the species' historical range. To achieve this, the Service must continue to cooperate with its conservation partners (e.g., Kentucky Department of Fish and Wildlife Resources (KDFWR), KDOW, KSNPC, TWRA, and U.S. Forest Service (USFS)) to enforce existing laws, regulations, and policies that protect against water quality degradation and habitat disturbance within the Cumberland Darter's range. Protection and management efforts are needed in each management unit where the species remains. This will require the cooperation of the Service, other Federal and State agencies, landowners, conservation organizations, and other interested parties. We must take advantage of existing conservation programs, such as the Partners for Fish and Wildlife (PFW) Program, KDFWR's Stream and Wetland Mitigation Program, and multiple Farm Bill programs, to work with landowners and implement conservation actions for the species. The Service must also work with its conservation partners to inform local governments and the public about the Cumberland Darter and describe measures that can be taken to protect its habitats.

In addition to actions designed to conserve, protect, and restore the species' habitats and populations, the Service needs to address a number of information gaps related to demographics, genetics, life history, habitat requirements, and threat sensitivity. A standardized monitoring program should be developed to track the species' status, and genetic research is needed to evaluate the level of diversity and gene flow across the species' range. Information on the species' life history is lacking, so research is needed to investigate the species' spawning behavior, longevity, food habits, habitat preferences, and species interactions. The species' tolerance to siltation, elevated temperatures, elevated conductivity, and other potential stressors should be evaluated using field or laboratory studies. Captive propagation should be used to augment or expand the species' current range. All of these monitoring and research actions will help to protect populations, guide federal and state coordination and permit review, and focus conservation and restoration efforts.

Management Units

For this Recovery Plan, we identify nine management units for the Cumberland Darter (refer to Recovery Implementation Strategy, Figure 1). Based on the species' current distribution (refer to Species Biological Report, Figures 1 and 2) and our knowledge of the species' movement patterns, we consider each management unit to represent a separate population. As genetic analyses are completed and more is known about the species' gene flow and genetic structure, it may be necessary to adjust or modify unit boundaries. All stream reaches within the species' historical range, not specifically identified in the following management units, should not immediately be excluded from recovery activities if new information indicates these areas are necessary to prevent local extirpation or to facilitate recovery.

The management units are as follows:

> Management Unit 1: The boundaries of this management unit correspond to critical habitat units 1 (Bunches Creek) and 2 (Calf Pen Fork), which are located entirely within the Daniel Boone National Forest (DBNF).

Management Unit 2: The boundaries of this management unit correspond to critical habitat units 7 (Kilburn Fork) and 8 (Laurel Fork). The majority of this management unit (73 percent) is located within the DBNF.

Management Unit 3: The boundaries of this management unit correspond to critical habitat unit 6 (Cogur Fork). The majority of this management unit (69 percent) is located within the DBNF.

Management Unit 4: The boundaries of this management unit correspond to critical habitat units 4 (Barren Fork) and 5 (Indian Creek), which are located entirely within the DBNF.

Management Unit 5: The boundaries of this management unit correspond to critical habitat units 9 (Laurel Creek), 10 (Elisha Branch), and 11 (Jenneys Branch), and a 7.4-km (4.6-mi) segment of Bridge Fork. The majority of this management unit (96 percent) is located within the DBNF.

Management Unit 6: This management unit corresponds to critical habitat units 13 (Jellico Creek), 14 (Rock Creek), and 15 (Capuchin Creek). A portion of this management unit (29 percent) is located within the DBNF.

Management Unit 7: The boundaries of this management unit correspond to critical habitat unit 3 (Youngs Creek). This unit is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings and road easements.

Management Unit 8: The boundaries of this management unit correspond to critical habitat unit 12 (Wolf Creek). This unit is located almost entirely on private land, except for any small amount that is publicly owned in the form of bridge crossings and road easements.

Management Unit 9: This management unit does not correspond to a critical habitat unit because the species was thought to be extirpated from Laurel Fork when the critical habitat rule was published in 2012. The species was rediscovered in Laurel Fork (of Clear Fork) by KSNPC and the Service in 2014 (Service unpublished data). This management unit is comprised of an approximate 16.7-km (10.4-mi) reach of Laurel Fork that extends from the mouth of Laurel Fork in Campbell County, Tennessee, upstream to the Laurel Fork-Buffalo Creek Road bridge crossing in Whitley County, Kentucky. No collection records exist for the Tennessee portion of this management unit (Campbell and Claiborne counties); however, recent collection records exist for areas near the Kentucky-Tennessee border, and suitable habitat is present throughout the Tennessee portion of the stream. This unit is located primarily on private property, except for a 6.6-km (4.1-mi) reach on the western side (right descending bank) of Laurel Fork in Archer-Benge State Nature Preserve, Whitely County, Kentucky, and any small amount that is publicly owned in the form of bridge crossings and road easements.

Recovery Goal: The goal of this recovery plan is to ensure the long-term viability of the Cumberland Darter in the wild to the point that it can be removed from the *Federal List of Endangered and Threatened Wildlife* (50 CFR 17.11).

Recovery Criteria:

Delisting:

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

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

Actions Needed (see the associated Recovery Implementation Strategy for stepped down actions):

(1) **Conserve, protect, and restore existing populations and habitats (Priority 1)[3]**. Habitat loss is the primary cause of range curtailment of the Cumberland Darter. Habitats throughout the species' range have been modified and degraded by a variety of human-induced impacts such as siltation, water pollution, loss of riparian corridors, and changes in channel morphology. Because of these impacts and potential barriers to dispersal, the species has been extirpated from numerous streams and now occurs in nine isolated watersheds. Habitats within these remaining watersheds must be protected and enhanced to meet the species' life history requirements and to ensure the species' long-term survival and viability of populations.

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[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.

[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 of time encompassing 5 generations (i.e., 15 years),
   b. Two or more age-classes are consistently present within that same period of time, 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 of time.
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.

[3]Recovery actions are assigned numerical priorities to highlight the relative contribution they may make toward species recovery (48 FR 43098):

Priority 1 – An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2 – An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 – All other actions necessary to provide for full recovery of the species.

(2) **Conduct research to determine the species' status, demographics, population genetics, and trends (Priority 1).** An monitoring program is needed to track the species' status, document the species' population structure and genetics, characterize habitat conditions, and determine the effectiveness of recovery actions. Research is needed to evaluate genetic differences across the species' range. These data are essential for defining reproductive exchange (flow) across the range, genetic diversity, hybridization, and genetically meaningful recovery progress. Other potentially suitable habitats within the species' range but outside of the management units, especially those on the DBNF, should be searched for undocumented populations or unoccupied suitable habitats.

(3) **Document the species' life history, habitat requirements, and threat sensitivity (Priority 2).** Little is known regarding the species' life history, microhabitat requirements, and threat sensitivity. Defining these requirements with controlled studies will help us protect populations, guide Federal and State coordination and permit review, and focus conservation and restoration efforts throughout the species' range.

(4) **Establish a propagation plan for the species that allows for the reintroduction of the species to new habitats (Priority 2)**. Two significant threats to the Cumberland Darter are its small population size and the isolated nature of its nine populations. A continuation and expansion of the current captive propagation and reintroduction program initiated by KDFWR, CFI, and the Service is needed to expand the species' current range, improve connectivity among populations, and protect against stochastic and catastrophic events.

(5) **Coordinate all activities and conduct periodic review of recovery progress and strategy (Priority 3)**. The recovery plan, the species biological report, its action items, and its implementation schedule, should be evaluated periodically to determine if the objectives are being achieved, and to incorporate new information or necessary modifications. The species will be monitored under Tasks 2.1, 2.2, and 4.4. Changes in distribution and habitat quality should be used to focus recovery efforts and adjust priorities as needed.

(6) **Increase public awareness of the species through outreach materials.** This action would include the development of web-based educational materials, as well as the distribution of fact sheets and other outreach materials within the upper Cumberland River drainage. Outreach efforts by the Service (PFW Program), KDFWR (Stream and Wetland Mitigation Program, *Kentucky Afield* magazine and TV program), Tennessee Wildlife Resources Agency (TWRA) (*Tennessee Wildlife* magazine, *Tennessee Wild Side* TV program), NRCS (Farm Bill programs), and KDOF (Master Logger program) should incorporate information on the species' biology, status, distribution, and threats.

Estimated Cost of Delisting: The estimated costs associated with implementing recovery actions for delisting are $35,805,000. Cost estimates reflect costs for specific actions needed to achieve Cumberland Darter recovery. Some costs for recovery actions are not determinable at this time; therefore, the total cost for recovery will be higher than this estimate.

Date of Recovery: The estimated date of recovery is 2047. As we learn more about this species and its threats and recovery actions are implemented and funded with close cooperation of all partners, we will carefully monitor and assess progress toward recovery to ensure we are on track.

Years	Action 1	Action 2	Action 3	Action 4	Action 5	Action 6	Total Cost
1-5	8M	100K	100K	25K	1.5K	25K	6.0M
6-10	8M	110K	100K	30K	1.5K	25K	9.0M
11-15	8M	35K		25K	1.5K	25K	8.3M
16-20	3.7M	35K		25K	1.5K	25K	3.7M
21-25	3.7M	35K		25K	1.5K	25K	4.4M
26-30	3.7M	35K		25K	1.5K	25K	3.2M
Total	35.1M	350K	200K	155K	9K	150K	35.9M

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Date: October 2017