

**Duskytail Darter (*Etheostoma percnurum*)**

**5-Year Review:  
Summary and Evaluation**



Duskytail Darter, Copper Creek  
Photo Credit: Conservation Fisheries Inc.

**U.S. Fish and Wildlife Service  
Atlanta Regional Office  
Tennessee Ecological Services Field Office  
Cookeville, Tennessee**

**5-YEAR REVIEW**  
**Duskytail Darter (*Etheostoma percnurum*)**

**I. GENERAL INFORMATION**

**A. Methodology used to complete the review:**

This review was completed by biologists in the Kentucky (KYFO) and Tennessee (TNFO) Ecological Services Field Offices, U.S. Fish and Wildlife Service (Service). The primary sources of information used in this analysis were the final listing rule for this species under the Endangered Species Act (Act) (58 FR 25758); the final recovery plan (Service 1994); the last 5-year review (Service 2012); peer reviewed scientific publications; reports; and unpublished field observations by Service and State biologists, along with other qualified biologists and experts. The public notice for this review was published in the Federal Register on April 11, 2019, with a 60-day public comment period (84 FR 14669). We evaluated and incorporated comments and suggestions from peer reviewers, as appropriate (Appendix A). We also evaluated and incorporated public comments and suggestions received, as appropriate (Appendix B).

**B. Reviewers:**

**Lead Region** - South Atlantic-Gulf Region: Carrie Straight, 404-679-7226

**Cooperating Region** - North Atlantic-Appalachian Region: Martin Miller, 413-253-8615

**Lead Field Office** - Tennessee Ecological Services: Warren Stiles, 931-525-4981

**Cooperating Field Offices** - Virginia Ecological Services: Jordan Richard, 276-623-1233  
Kentucky Ecological Services: Carrie Allison, 502-695-0468

**C. Background**

**1. Federal Register Notice citation announcing initiation of this review:** April 11, 2019 (84 FR 14669)

**2. Listing history**

Original Listing

FR Notice: 58 FR 25758

Date Listed: April 27, 1993

Entity Listed: Species

Classification: Endangered

**3. Associated rulemakings:**

September 13, 2007. Establishment of Nonessential Experimental Population Status for 15 Freshwater Mussels, 1 Freshwater Snail, and 5 Fishes in the Lower French Broad River and in the Lower Holston River, TN. 72 FR 52434.

August 12, 2002. Establishment of Nonessential Experimental Population Status and Reintroduction of Four Fishes in the Tellico River. 67 FR 52420.

**4. Review History:**

Each year, the Service reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we submitted information for the annual recovery data call for the duskytail darter. We continue to show the species' status recommendation in 5-year reviews. The last five-year review for the duskytail darter was completed on July 27, 2012 (Service 2012). This review recommended that the species remain listed as endangered because of ongoing threats related to coal mining, oil and gas exploration, agriculture, and recreational activities.

**5. Species' Recovery Priority Number at start of review:**

The duskytail darter's recovery priority number is 2. The "2" indicates a species with a high degree of threat and a high recovery potential.

**6. Recovery Plan:**

Name of plan: Duskytail Darter Recovery Plan

Date issued: March 30, 1994

**II. REVIEW ANALYSIS**

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

1. **Is the species under review listed as a DPS?** No
2. **Is there relevant new information that would lead you to consider listing this species 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, since the time of the recovery plan, four morphologically discrete species have been described from the duskytail darter species complex (Blanton and Jenkins 2008). This includes the marbled darter (*Etheostoma marmorpinnum*), Citico darter (*E. sitikuense*), tuxedo darter (*E. lemniscatum*), and duskytail darter (*E. percnum*). We included a detailed discussion of taxonomy in the 2012 5-year status review (Service 2012). We present additional recovery information in Section C below. For the remainder of this review, we will address each species separately, but will also provide a summary for the entire complex that addresses the listed entity of duskytail darter.
  - (b) **Are all of the five listing factors that are relevant to the species addressed in the recovery criteria?** No, because the recovery criteria were developed in 1994 when the marbled darter, Citico darter, tuxedo darter, and duskytail darter were complexed together

as one a single listed entity. The recovery criteria does not reflect the current life history and threats-based information for each distinct species.

- 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.** Criteria necessary to delist the duskytail darter have not been met. The duskytail darter will be considered for reclassification to threatened status when:

***Downlisting Criteria 1 - Three distinct viable populations exist, through protection and enhancement of the existing populations in the Little River, Blount County, Tennessee; Citico Creek, Monroe County, Tennessee; Big South Fork, Scott County, Tennessee; and Copper Creek and Clinch River, Scott County, Virginia, and successful establishment of a reintroduced population in Abrams Creek or other historic habitat or the discovery of an additional population.***

*Viable population: A reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural habitat changes. The number of individuals needed and the amount and quality of habitat required to meet this criterion will be determined for the species as one of the recovery tasks.*

This criterion has not been fully met. The populations discussed in this criterion now encompasses the ranges of the four species described above. In total, six geographically separated populations of the listed entity now exist (see Section II.C.1.a. below), but their viability has not been evaluated. In particular, the duskytail darter in Copper Creek/Clinch River appear to be declining (J.R. Shute pers. comm. 2020). Reintroductions have been successful at establishing stable populations in Abrams Creek (reintroduced beginning in 1992) and in Tellico River (reintroduced beginning in 2002) using brood stock from Citico Creek.

***Downlisting Criteria 2 - Studies of the fish's biological and ecological requirements have been completed and the implementation of management strategies developed from these studies has been or is likely to be successful.***

This criterion has not been fully met because data developed after publication of the recovery plan indicates that four distinct species exist. Therefore, further research for each of the species is warranted, but some life history aspects are known that are likely attributable to each species and are included in 2012 5-year review and in Section II.C.below.

***Downlisting Criteria 3 - No foreseeable threats exist that would likely threaten the survival of any of the three aforementioned populations.***

This criterion has not been met. At the time of listing, the threats to the duskytail darter complex included impoundments, siltation, water withdrawals, pollution, agricultural, runoff, chemical spills, and water quality degradation from poor land use practices. These

threats still remain and are included in a discussion of the current threats presented in Five-factor Analysis (II.C.2.) section below.

## C. Updated Information and Current Species Status

### 1. Biology and Habitat

#### (a) Abundance, population trends, demographic features or demographic trends:

The listed entity, duskytail darter, is considered stable in the Little River, Citico Creek, Abrams Creek, and Big South Fork; stable or expanding in the Tellico River; declining in Copper Creek; and unknown status in the Clinch River. Information about each watershed and descriptions addressing the duskytail darter complex are detailed below.

#### Marbled Darter:

**Little River** – Currently, the Little River population is stable (J.R. Shute 2020, pers. comm.). Conservation Fisheries Incorporated (CFI) considers this augmentation to be marginally successful at most locations, with scattered records of propagated individuals found in recent surveys (J.R. Shute 2020, pers. comm.). On August 6, 2019, Austin Peay State University (APSU) and CFI completed snorkeling surveys at three sites along the Little River (Brumley and Blanton 2020). They observed 117 individuals, representing several age classes, including young of year, indicating recruitment is occurring.

#### Citico Darter:

**Citico Creek** – In 2006, a total of 220 Citico darters and 24 nests were observed in Citico Creek (Rakes and Shute 2007). In an attempt to expand the range of the species in Citico Creek, 100 Citico darters were stocked upstream of the low-head dam in 2018 and 48 were stocked upstream of the low-head dam in 2019. This low-head dam is a barrier to upstream migration, and prior to stocking upstream of the dam, the majority of Citico darters were found downstream of this dam (P. Shute 2020, pers. comm.). Based on recent observations by CFI, the Citico Darter continues to be stable in Citico Creek (J.R. Shute 2020, pers. comm.), and is reproducing at the monitoring site upstream of the dam (Rakes *et al.* 2021).

**Abrams Creek** – The Citico darter was extirpated from Abrams Creek, Great Smoky Mountains National Park (GRSM), Blount County, TN in 1957 as a result of rotenone application (Lennon and Parker 1959). In 1992, CFI began captive propagation and reintroduction of the Citico darter into Abrams Creek using eggs taken from nests in nearby Citico Creek. In 2012, the GRSM developed a monitoring protocol designed specifically for the Citico darter, smoky madtom (*Noturus baileyi*), and yellowfin madtom (*N. flavipinnis*) (Kulp and Abramson 2015). This protocol was adapted from protocols developed to monitor the tuxedo darter in Big South Fork National River and Recreation Area in KY and TN (Davis *et al.* 2011).

The lower 17.4 km (10.81 mi) of Abrams Creek was broken into three zones for the purpose of annual monitoring (Kulp and Abramson 2015). These sections are: Zone 1 (Embayment of Fontana Reservoir to just upstream of Bell Branch), Zone 2 (just upstream

of Bell Branch to just downstream of the Rabbit Creek Trail Crossing), and Zone 3 (just downstream of the Rabbit Creek Trail Crossing to about 1.0 km (0.62 mi) upstream of the Abrams Creek campground). Monitoring results (2012-2019) show that Zone 3 continues to have the highest densities (number/100m<sup>2</sup>) of adult and juvenile Citico darters. Monitoring data along with recent observations by CFI biologists indicate strong Citico darter annual reproduction and recruitment in Zones 2 and 3 in Abrams Creek, as such, Abrams Creek appears to be stable and possibly expanding and contributing toward recovery (J.R. Shute 2020, pers. comm.).

**Tellico River** – In 2002, CFI began captive propagation of Citico darters for introduction into the Nonessential Experimental Population established for the Tellico River (67 FR 52420) to help recover the species. Eggs taken from nests in nearby Citico Creek were used to propagate young for the introduction efforts. According to Rakes *et al.* (2020) a total of 7,566 Citico darters have been reintroduced into Tellico River through 2019. These introductions are still occurring and there is evidence of natural reproduction and successful recruitment (Rakes *et al.* 2020). Based on recent observations by CFI, the population in the Tellico River appears to be stable and possibly expanding within the river (J.R. Shute 2020, pers. comm.).

Tuxedo Darter:

**Big South Fork** – Tuxedo darters have consistently been observed in the Big South Fork since at least 1998. Prior to implementation of emergency operations at Wolf Creek Dam in 2007, the tuxedo darter was confirmed in at least 14 shoals, extending from Big South Fork River Mile (BSFRM) 66.5 downstream to BSFRM 45.1 at Blue Heron. The temporary drawdown of Lake Cumberland created reaches of free-flowing habitat that had previously been inundated and unsuitable for duskytail darters. In November 2013, the Tennessee Valley Authority (TVA) (contracted by the United State Army Corps of Engineers) conducted aquatic surveys of all shoal complexes located between BSFRM 45.1 and BSFRM 34.4. Duskytail darters were observed at seven new shoals (Sites 2 through 8) and suitable habitat was identified at one new shoal in 2013 (Site 9). This expanded the number of known occurrences within the Big South Fork from 14 to 21 (Simmons and Shaffer 2013).

Lake Cumberland was returned to historical pool levels during the summer of 2014. The new sites, as well as the Blue Heron site were surveyed for tuxedo darters annually each fall from 2014 to 2019. In September and October of 2019, APSU and TVA surveyed tuxedo darters at 11 sites throughout the species' range in the Big South Fork. They observed 131 individuals, but fewer individuals were found in re-inundated reaches, suggesting declines in occurrence and abundance at these sites. Of the fish collected, a majority were age-0, few were age-1, while no older fish were represented. Recruitment of age-0 fish was primarily restricted to the upper sites. As hypothesized by Simmons (2019), the duration and magnitude of reservoir inundation at these sites during 2018 and 2019 resulted in deterioration (siltation) of tuxedo darter habitats. This was substantiated by the decrease or absence of individuals throughout the reach (Simmons 2020, pers. comm.; Brandt 2020, pers. comm.).

The Service expected these new sites to return to pre-drawdown conditions once normal operations were restored and to no longer be suitable for duskytail darters (Service 2014). Therefore, the expansion of the range was considered temporary. Currently, three of the previously inhabited sites (Sites 6, 7, and 8) no longer support tuxedo darters and Site 9 no longer provides suitable habitat. Duskytail darters continue to be stable at Sites 2, 3, 4, and 5 and at the locations that are not affected by the operations at Wolf Creek Dam.

### Duskytail Darter:

**Copper Creek and Clinch River** – The historical range of the duskytail darter includes 28.96 km (18 mi) of Copper Creek in Scott and Russell counties, VA, and at a single site in the Clinch River, Scott County, VA, near the mouth of Copper Creek. The duskytail darter has shown a marked decrease in both number of known sites and abundance since 2008. The range of the species has declined to 14.48 km (9 mi). The darter was present at seven sites in 2008 but was restricted to only two sites during surveys completed in 2018 (CFI 2018).

The Copper Creek Conservation Committee in 2016 identified 32.19 km (20 mi) of suitable habitat in the upper Clinch River for reintroduction efforts of the duskytail darter to prevent the imminent extinction of this species (estimated 8-10 years) (Petty *et al.* 2019). The sites targeted for reintroduction included the area around the VA 652 bridge at Puckett's Hole and the Artrip bridge (VA 661) in VA (CFI 2017). Nest collection from Copper Creek began in late spring 2017 and as of 2019, 768 duskytail darters have been released at the Artrip Bridge site in the Clinch River. Future assessment of these introduced individuals is needed to understand their viability in the system.

**(b) Genetics, genetic variation, or trends in genetic variation:** The duskytail darter complex is vulnerable to losses in genetic diversity and fitness due to isolation and small population size. 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 and decreasing their ability to adapt to environmental changes (Allendorf and Luikart 2007). An update on the genetics of each of the four species in the duskytail darter species complex, as described by Blanton and Jenkins (2008), is given below:

Marbled Darter: Preliminary genetic diversity results are currently being examined by APSU based on data collected at six microsatellite loci from the fin clips of 56 marbled darters. Allele number per locus varied from two to nine alleles (Brumley and Blanton 2020). Basic genetic diversity metrics and population structure were analyzed and showed pair-wise fixation values were low and not significant, indicating that the populations examined do not deviate from random mating (Brumley and Blanton 2020). This and other preliminary analyses of population structure suggest that the marbled darter is comprised of a single population and that gene flow occurs at some level among the three localities of this species. However, the origin of this population creates some potential issues for inferences regarding genetic diversity and population connectivity because it is descended from a propagated group of marbled darters reintroduced into the area by CFI (Brumley and Blanton 2020). CFI took individuals from two locations to create the

reintroduced group, which may have resulted in inbreeding in this subpopulation (Brumley and Blanton 2020). In summary, the marbled darter has relatively low genetic diversity, which likely reduces its adaptive potential; however, the subpopulations of this darter are not isolated, and preliminary genetic data suggest yearly transfer of genetic material throughout the range (Brumley and Blanton 2020).

Citico Darter: A study by Moyer and Williams (2012) was conducted to provide an assessment of the genetic risks associated with the Abrams Creek reintroduction effort of Citico darters and to provide base-line genetic data for genetic risk assessment and monitoring of Citico darters inhabiting Citico Creek. Major findings of this study include (1) there are low levels of genetic diversity in Citico darters, (2) estimates of genetic diversity (i.e., allelic richness and expected heterozygosity) were similar and suggest that the reintroduction program has been successful in the preservation of genetic diversity between source and founding populations, (3) simulations indicated at least four effective migrants per generation are necessary to minimize genetic differentiation between Citico Creek and Abrams Creek populations, and (4) low levels of genetic diversity in Citico Creek are likely attributed to historical deforestation of the surrounding watershed in the 1900s.

Tuxedo Darter: Washburn *et al.* (2020) investigated the effects of distance, intervening pools, and rapids on gene flow in the tuxedo darter, which is presumed to be a dispersal-limited species. Using 20 microsatellites from 163 individuals collected from 18 habitat patches, Washburn *et al.* (2020), observed low levels of genetic structure that were related to geographic distance and rapids, though these factors were not barriers to gene flow. Pools separating habitat patches did not contribute to any observed genetic structure. Overall, it was found that the tuxedo darter maintains gene flow across its range and is comprised of a single population. Due to the linear distribution of the species, a stepping-stone model of dispersal best explains the maintenance of gene flow across its small range, and the observation of higher-than-expected connectivity likely stems from an adaptation to disperse due to temporally unstable and patchy habitat (Washburn *et al.* 2020).

Brumley and Blanton (2020) are currently extracting DNA from tissues collected from tuxedo darters in the Big South Fork to give a more robust estimate of genetic diversity in the species.

Duskytail Darter: Work is currently underway at APSU to look at the genetic diversity of the duskytail darter.

**(c) Taxonomic classification or changes in nomenclature:**

As described in the previous 5-year review Blanton and Jenkins (2008) described three new morphologically diagnosable species among the four duskytail darter populations (Copper Creek, Big South Fork, Citico Creek, and Little River). Based on the best available information, the Service believes the original listing of duskytail darter should be re-evaluated to consider new taxa established by the work of Blanton and Jenkins (2008) (see section IV. Future Recommendations).

**(d) Spatial distribution, trends in spatial distribution, or historic range:**

Overall, the distribution of the duskytail darter species complex is stable or declining.

Marbled Darter: The marbled darter is currently restricted to 14.48 km (9 mi) of the lower Little River in Blount County, TN (Blanton and Jenkins 2008).

Citico Darter: The only known natural population of Citico darters remains in Citico Creek, a tributary of the Little Tennessee River, located in Monroe County, TN. The Citico darter is currently restricted to approximately 9.3 km (5.75 mi) of Citico Creek (Rakes 2011, pers. comm.). The Citico darter currently occurs in 4.0 km (2.5 mi) of Abrams Creek in Blount County, TN (Gibbs 2009) and 2 miles of the Tellico River in Monroe County, TN (Petty *et al.* 2011).

Tuxedo Darter: The tuxedo darter occupies an approximate 38.62 km (24 mi) reach of the Big South Fork. Patches of suitable habitat within the river are separated by distances greater than 0.9 km (0.6 mi). Previously, it was unknown if the tuxedo darter could disperse across pool habitats; however, Washburn *et al.* (2020) demonstrated that gene flow was not limited by pool or rapid habitats and dispersal through these habitats occurs.

Duskytail Darter: The historical range of the species includes 28.97 km (18 mi) of Copper Creek, Scott and Russell counties, VA, and one site in the Clinch River, Scott County, VA, near the mouth of Copper Creek. The species is now limited to Copper Creek and a reintroduction site in the Clinch River. It is likely that the duskytail darter previously existed at several other locations in the Clinch River system (Jenkins and Burkhead 1994). The duskytail darter has shown a marked decrease in both number of known sites and abundance with the range of the species, declining to 14.5 river km (9 mi) (Petty *et al.* 2017).

**(e) Habitat:**

Overall, the habitat preferences of the duskytail darter species complex are very similar, however individual site and habitat preferences from various studies are detailed below.

Marbled Darter: Marbled darter<sup>1</sup> habitat is characterized by moderate gradient with riffles, runs, and long pools. The species is primarily associated with pools and moderate runs about 0.3 to 1.2 m (11.81 in to 47.24 in) deep with clean pebbles, cobble, and small boulders (Layman 1991).

Citico Darter: Gibbs (2009) characterized the macrohabitat use of the Citico darter and found presence to be strongly correlated with small boulder substrates. Miller (2011) concluded that the presence of pool habitat was the greatest single habitat variable that influenced Citico darter presence in Abrams Creek. At the macrohabitat level, presence of Citico darters was strongly associated with availability of intermediate-sized (i.e., cobble and small boulder) substrates and pool habitats. Reaches with Citico darters were

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<sup>1</sup> The habitat description in Layman (1991) refers to duskytail darter habitat in the Little River that is now recognized as habitat for the marbled darter.

dominated by cobble, and most individuals were found beneath cobble or small-boulder cover rocks (Gibbs *et al.* 2014)

Tuxedo Darter: The tuxedo darter range in the Big South Fork is limited to a small number of separated localities within a 24-mile area of the mainstem. Davis (2010) characterized the microhabitat use of the tuxedo darter. The tuxedo darter uses glides, or slow-flowing, shallow areas with an abundance of cobble or boulder-sized cover rocks (Davis 2010).

Duskytail Darter: The duskytail darter occupies the lower main channel of Copper Creek, which is a clear, warm, moderate-gradient stream. Adults occur primarily in pools, and much less frequently in swift runs, where they are associated with relatively clean gravel, cobble, and boulders. The range of habitats includes slack water, detritus, slightly silted stones, and bedrock (Jenkins and Burkhead 1994).<sup>2</sup>

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

**(a) Present or threatened destruction, modification or curtailment of its habitat or range:** The species continues to be threatened by stressors described in the Recovery Plan (Service 1994). These include impoundments, water withdrawal, urbanization, coal mining, toxic chemical spills, siltation, improper pesticide use, streambank erosion, agriculture, resource extraction, road construction, non-point source pollution, and urban development (Waters 1995). No new substantial threats have been identified for taxa in the duskytail darter complex since the 2012 5-year review; however, personal observations (J.R. Shute 2020, pers. comm.) suggest that invasive crayfishes could pose a potential threat to the reproductive behavior of the duskytail darter (Carter 2020 pers. comm.) and the building of temporary rock dams in the Little River could remove potential nest rocks used by the marbled darter.

**(b) Overutilization for commercial, recreational, scientific, or educational purposes:** Overutilization is not thought to be a threat to the duskytail darter species complex.

**(c) Disease or predation:** Neither disease nor predation is thought to be a threat to the duskytail darter species complex.

**(d) Inadequacy of existing regulatory mechanisms:** The duskytail darter complex and its habitats is afforded limited protection from water quality degradation under the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.). The marbled darter, Cítico darter, and tuxedo darter and their habitats are also afforded limited protection from water quality degradation under the Tennessee Water Quality Control Act of 1977. The tuxedo darter, in KY, is also protected by the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1234 – 1328), Kentucky’s Forest Conservation Act of 1998 (KRS 149.330-355), Kentucky’s Agriculture Water Quality Act of 1994 (KRS 224.71-140), additional Kentucky laws and regulations regarding natural resources and environmental protection

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<sup>2</sup> The habitat description in Jenkins and Burkhead (1994) refers to duskytail darter habitat in Copper Creek and other proximal portions of the Clinch River.

(KRS 146.200-360; KRS 224; 401 KAR 5:026, 5:031). These laws focus on point-source discharges, and many water quality problems are the result of non-point source discharges. Therefore, these laws and corresponding regulations have been inadequate to halt population declines and degradation of habitat for these species.

Existing regulatory mechanisms (e.g., Clean Water Act) have provided for some improvements in water quality and habitat conditions but they have been inadequate in fully protecting the species and its habitats. Sedimentation and non-point source pollutants continue to be a significant problem across the species' range. 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.

**(e) Other natural or manmade factors affecting its continued existence:** Protection of the genetic diversity seen in the duskytail darter, as it was listed, relies on maintaining viable populations of each of the species within the complex. The species in this complex (e.g., marbled darter, Citico darter, tuxedo darter, and duskytail darter) have limited geographic ranges and small population sizes that increase the species vulnerability to localized extinctions and decreased fitness from reduced genetic diversity. Any one of the species in the complex is vulnerable to single catastrophic impacts to the watershed (e.g., chemical spills). Potential sources of such spills include accidents involving vehicles transporting chemicals over road crossings of streams inhabited by the darters and accidental or intentional release into streams of chemicals used in agricultural or residential applications.

#### **D. Synthesis**

The duskytail darter populations in the Little River (marbled darter), Citico Creek (Citico darter), and Big South Fork (tuxedo darter) appear to be stable. Populations were reintroduced into Abrams Creek (Citico darter) and Tellico River (Citico darter) that also appears to be reproducing and stable. However, the duskytail darter has shown a marked decrease in both number of known sites and abundance in Copper Creek since 2008. In Copper Creek the species' range has declined to 14.5 river km (9 mi) and it is now restricted to only 2 of 10 historical sites (CFI 2018). Overall the complex occurs in 80.9 km (50.3 mi) of river, with 14.5 km (9 mi) associated with the marbled darter, 13.3 km (8.3 mi) the Citico darter, 38.6 km (24 mi) the tuxedo darter, and 14.5 km (9 mi) the duskytail darter. Based on ongoing threats associated with coal mining, oil and gas exploration, agriculture, recreational activities, restricted range/small population size, and the species decline in Copper Creek, the duskytail darter continues to be in danger of extinction throughout their range. Therefore, the status of the duskytail darter should remain as endangered.

### **III. RESULTS**

#### **A. Recommended Classification:**

  X   No change is needed

**B. New Recovery Priority Number: 5**

In the 2007 Recovery Data Call, the duskytail darter was given a recovery priority number of 2, reflecting a high degree of threat and high recovery potential. Threats to the duskytail darter complex remain high. Reintroduction efforts in Abrams Creek were successful. However the original extirpation of the species there was the result of a catastrophic incident, so it may be a unique instance. That success has not been replicated in other portions of the complex's range and may indicate difficulty in reintroductions/augmentations in other streams where extirpation may be associated with other threats. Therefore, we recommend a recovery priority number of 5 (high degree of threat, low recovery potential). We believe it is appropriate to consider a low recovery potential because the primary threats that affect all species within the duskytail darter complex are primarily from non-point sources that are not easily remedied, making recovery efforts challenging.

**IV. RECOMMENDATIONS FOR FUTURE ACTIONS**

All Species:

- Evaluate the status of each taxon in the complex and determine if each warrants individual protection under the Act.
- Continue to monitor population levels and habitat conditions of current populations.
- Characterize habitat (relevant physical, biological, and chemical components) for all life history stages.
- Continue to utilize existing legislation and regulations to protect the fish and its habitats.
- Continue efforts to reduce non-point source pollution from agricultural activities and resource extraction by working through the Partners for Fish and Wildlife, Farm Bill, and other incentive programs and by implementing best management practices.
- Develop a genetics protocols for propagated reintroduction and for augmenting existing populations

Marbled Darter

- Conduct genetic analyses to determine within population genetic diversity. Consider captive propagation for reintroductions into the South Fork Holston River or augmentation within upstream reaches of the Little River. If propagation is found warranted, prepare a propagation plan for the species.

Citico Darter:

- Continue genetic analyses comparing diversity within and among Citico darter populations.
- Conduct further research to determine if horse trail use and recreational users building temporary rock dams and chutes in Citico Creek negatively affects the species.

Tuxedo Darter:

- Determine if the current range of the species (24 miles) should be reduced based on degradation of sites that were created during the drawdown of Lake Cumberland.
- Determine if the rusty crayfish (*Faxonius rusticus*) is causing the displacement of tuxedo darter nesting habitat.
- Continue to remediate areas affected by acid mine drainage in the Big South Fork.

Duskytail Darter:

- Continue to monitor the Clinch River to determine species presence or absence in the river.
- Continue propagation and reintroduction efforts for the duskytail darter.
- Investigate additional reintroduction locations.
- Continue research on the causes of decline in Copper Creek

**V. REFERENCES**

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## Duskytail Darter 5-Year Review

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**U.S. FISH AND WILDLIFE SERVICE  
5-YEAR REVIEW of Duskytail Darter (*Etheostoma percnurum*)**

Current Classification Endangered

Recommendation resulting from the 5-Year Review

- Downlist to Threatened**
- Uplist to Endangered**
- Delist**
- No change is needed**

Review Conducted By Carrie Allison, Kentucky Ecological Services Field Office

**FIELD OFFICE APPROVAL:**

**Field Supervisor, Tennessee Ecological Services Field Office, Fish and Wildlife Service**

Approve \_\_\_\_\_ Date \_\_\_\_\_

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

**OTHER REGIONAL OFFICE APPROVAL:**

We emailed this 5-year review to the following regional and/or field offices for their concurrence prior to finalizing the document: Hadley, Massachusetts Regional Office and Virginia Field Office. We will retain any comments that we received, as well as verification of concurrence from other regions, in the administrative record for this 5-year review.

**APPENDIX A:**

**Summary of peer review for the 5-year review of duskytail darter (*Etheostoma percnurum*)**

- A. **Peer Review Method:** The draft document was peer-reviewed by Peggy Shute (CFI), Bernard Kuhajda (Tennessee Aquarium Conservation Institute), and Jeff Simmons (TVA). Coordination and solicitation of peer review was conducted by Carrie Straight, Atlanta Regional Office. Peer review comments were incorporated into the document as appropriate.
- B. **Peer Review Charge:** Peer reviewers were not given specific directions or forms to fill out for their review.
- C. **Summary of Peer Review Comments/Report:** The peer reviewers considered the revised 5-year review to be biologically sound and agreed with the species' status information and proposed conservation actions. They agreed that the review was based on the best available scientific information. Most comments were editorial in nature or included clarifications to data received during the data call, information that was not received during the data call, or information that was not available at the time of the data call. Additional data and clarifications to data were incorporated throughout, as appropriate. Substantive comments included: (1) Revision of the interpretation of the Moyer and Williams (2012) assessment of the genetic risks associated with the Abrams Creek reintroduction effort of Citico darters inhabiting Citico Creek; (2) A recommendation to include establishing genetics protocols for propagated fishes to be reintroduced and for propagated fishes used for augmentation of existing populations; (3) A recommendation by several commenters to consider potential new threats including: rock dams and horse trails in Citico Creek, mycobacterium, the rusty crayfish (*Faxonius rusticus*) in Big South Fork, and persisting acid mine drainage; (4) A recommendation to add McCreary County, KY to Downlisting Criteria 1; (5) A recommendation to add an observation from September 2020 that no tuxedo darters were found at Sites 7 and 8 in Big South Fork; (6) A recommendation to note that some of the highest genetic diversity metrics were present in individuals at TVA Site 5 in the re-inundated reach (Washburn *et al.* 2020), that loss of these individuals may have lasting effects on long-term population stability, and that degradation of these habitats is significant; (7) Concerns with the section 7(a)(2) consultation regarding the Wolf Creek Dam Return to Normal Operations formal consultation; (8) One commenter disagreed that the tuxedo darter in Big South Fork is considered "stable" and suggested it should be "declining"; and (9) All reviewers emphasized the importance of recognizing the revised taxonomy and recommended that that each species in the duskytail darter complex be considered for listing under the Act
- D. **Response to Peer Review –** Due to the revised taxonomy, the 5 year review recommends that the newly described species in the duskytail darter species complex be considered for listing under the Act. Peer reviewer edits were incorporated into the revised document. More substantive comments summarized above were addressed as follows: (1) Clarification was provided regarding the interpretation of Moyer and Williams (2012) genetic risk assessment; (2) The recommendation to establish genetics protocols for propagated fishes to be reintroduced and for propagated fishes used for augmentation was

added as a recommendation for future actions for all species in the complex; (3) Determining if rock dams and horse trails are a threat to the Citico darter and if the rusty crayfish is a threat to the tuxedo darter were added as future recommendations for these species. Mycobacterium was not added as a threat because we have no evidence that mycobacterium affects the species in the wild. Acid mine drainage was not added as new threat because this threat has been identified in previous reviews; however, continuing to remediate acid mine drainage in the Big South Fork was added as a future recommendation for the tuxedo darter; (4) McCreary County, KY is not included in the criterion in the 1994 Recovery Plan; therefore, Recovery Criteria 1 was not revised; (5) The September 2020 tuxedo darter occurrence information was added as a personal communication in the “Updated Information and Current Species Status” section of this review; (6) The degradation of sites in the Big South Fork that were created during the drawdown of Lake Cumberland are addressed throughout the document, as appropriate; (7) The operations at Wolf Creek Dam are addressed throughout this document, as appropriate. Concerns with previously completed, project-specific section 7(a)(2) consultations are not addressed in this review; (8) Two of the three commenters agreed that the tuxedo darter is stable in Big South Fork. The expansion of the range as a result of operations at Wolf Creek Dam was considered temporary. Duskytail darters still persist at new Sites 2, 3, 4, and 5 (unoccupied at the time of the last review) and at all locations that are not affected by the operations at Wolf Creek Dam. The status of the tuxedo darter did not change from “stable” to “declining” for this review; and (9) the recommendation to recognize the revised taxonomy is included throughout the review, as appropriate, and the recommendation to evaluate the taxa for ESA listing has been noted.

**APPENDIX B:**  
**Summary of public comments for the 5-year review of duskytail darter (*Etheostoma percnurum*)**

We received public comments from two entities during the open comment period in 2019. These came from the National Council for Air and Stream Improvement, Inc. (NCASI) dated June 10, 2019 and from the TVA dated June 10, 2019.

**NCASI:** NCASI is a non-profit organization that serves forest landowners and the forest products industry by providing technical information and scientific research needed to achieve the industry's environmental goals and principles. On behalf of NCASI, Philip Weatherford, Angela L. Larsen, Erik B. Schilling, and Darren A. Miller highlighted the following in their comments: 1) forestry best management practices (BMPs) are implemented at high rates nationally and within the range of the duskytail darter, 2) forestry BMPs are effective for protecting water quality and habitat for at-risk species, 3) forestry BMPs are effective for protecting aquatic biota, and 4) contributions of forestry BMPs to conservation of aquatic organisms has previously been recognized by the Service.

NCASI states that within the range of the duskytail darter implementation rates of forestry BMPs are high and risks to water quality from forest management are low. In this 5-year review, we recognize that the most significant duskytail darter stressor is siltation caused by activities such as agriculture, resource extraction, road construction, and urban development (Waters 1995). We do agree that normal silviculture practices should include implementation of BMPs to avoid and/or minimize impacts to the species and have included this as a recommendation for future actions in Section IV.

**TVA:** TVA's submittal included species-specific data provided and collected by TVA biologist Jeff Simmons. This data has been incorporated in the 5-year review and is referenced throughout the document, in addition to species-specific comments submitted directly by Jeff Simmons on February 11, 2020.