

Duskytail Darter (*Etheostoma percnurum*)

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



**Duskytail Darter, Copper Creek specimen,
photo by Conservation Fisheries Inc. (CFI)**

**U.S. Fish and Wildlife Service
Tennessee Ecological Services Field Office
Southeast Region
Cookeville, Tennessee**

5-YEAR REVIEW

Duskytail Darter (*Etheostoma percnurum*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on available information pertaining to historic and current distributions, life histories, and habitats of this species. Our sources include the final rule listing this fish under the Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. The Service's lead recovery biologist for this species conducted the review. The public notice for this review was published on July 28, 2006, with a 60-day public comment period (71 FR 42871). No comments were received from the public. Peer review is summarized in Appendix A.

B. Reviewers

Lead Region – Southeast Region: Kelly Bibb, 404-679-7132

Cooperating Region – Northeast Region: Mary Parkin, 617-417-3331

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C. Background

1. Federal Register Notice citation announcing initiation of this review: July 28, 2006, 71 FR 42871

2. Species status: Stable, 2011 Recovery Data Call; No new information is available to indicate that threats have increased over the past year for any of the duskytail darter populations. The Big South Fork, Clinch, and Citico River populations appear to be stable. However, based on observations by CFI, the Little River population appears to be declining. These populations are now considered to be separate species in published literature (see Taxonomy section p. 11 of this review).

3. Recovery achieved: 2 (2 = 26-50% species recovery objectives achieved)

4. Listing history

Original Listing

FR notice: 58 FR 25758

Date listed: April 27, 1993

Entity listed: Species

Classification: Endangered

5. 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, Tennessee. 72 FR 52433.

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

6. Review History:

Final Recovery Plan, 1994

Recovery Data Call, 1998-2011

7. Species' Recovery Priority Number at start of review (48 FR 43098):

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

8. Recovery Plan:

Final Recovery Plan, 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 as a DPS in accordance with the 1996 policy? No**

B. Recovery Criteria

- 1. Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes**

2. **Adequacy of recovery criteria.**

- a. **Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?** No, three new morphologically diagnosable species have been described from the duskytail darter species complex (Blanton and Jenkins 2008). The Service believes this information is supported in the scientific community and recommends in this review that these three new species be considered for listing under the Endangered Species Act of 1973, as amended (Act) (see section IV. Recommendations for Future Actions). A 5-year review is not a rulemaking document. For the Service to initiate a new listing action, we would have to do so through the rulemaking process. If the species complex is recognized by the Service, a new Recovery Plan (s) may have to be considered, incorporating threats based criteria for each species, including the originally listed duskytail darter.
- b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?** No, the recovery criteria do not reflect the current knowledge of the species and do not include threats based information considered separately for each of the four species in the duskytail darter complex. To reflect the best available information, we are going to present the species complex identified in Blanton and Jenkins, 2008, from this point in the document. We note that this 5-year review will not change duskytail darter's original listing under the Act. The Service must initiate the rulemaking process (which includes a proposed rule and open public comment period) to do this.

3. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.**

The duskytail darter will be considered for reclassification to threatened status when:

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 of the Cumberland River, 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 met. Six geographically separated populations now exist, but their viability has not been evaluated. In addition, three new morphologically diagnosable species have been described from the duskytail darter species complex (Blanton and Jenkins 2008), resulting in a total of 4 species (Table 1). These descriptions were based on the examination of meristic, morphometric, and pigmentation analyses that showed substantial variation among the four duskytail darter populations (Copper Creek, Big South Fork, Citico Creek, and Little River) (Blanton and Jenkins 2008). The Copper Creek population remains under Blanton and Jenkins evaluation the duskytail darter, *E. percnurum* (Clinch River system, Tennessee River drainage); the Citico darter (*E. sitikuense*) is described from Citico Creek, Abrams Creek, and Tellico River in the Tennessee River system; the Marbled darter (*E. marmorpinnum*) is described from the Little River and South Fork Holston River in the Tennessee River system; and the Tuxedo darter (*E. lemniscatum*) is described from the Big South Fork of the Cumberland River (Blanton and Jenkins 2008).

Table 1. Localities for the four species in the duskytail darter species complex (Blanton and Jenkins 2008).

	Marbled Darter	Citico Darter	Tuxedo Darter	Duskytail Darter
River System	Tennessee River	Tennessee River	Cumberland River	Tennessee River
River locals	Little River	Citico Creek	Big South Fork	Clinch River Copper Creek

An update on the status of each of the four species in the duskytail darter species complex as described by Blanton and Jenkins 2008 is given below:

Marbled darter (*E. marmorpinnum*):

Little River - Marbled darters were known from only two sites in the lower Little River, until CFI discovered a third in 1999 (CFI 2004). In 2003, CFI began captive propagation and augmentation of duskytail darters in the Little River due to declining populations in the river. Over 100 propagated duskytail darters were released above US 411 (CFI 2004). The following summer, five individuals were found at the release site, including one individual representing the progeny of a successful spawn in the river. Since 2003, a total of 719 propagated duskytail darters have been stocked at three sites in the Little River. As of 2011, the Little River population is remaining generally stable, but not identifiable due to these efforts yet. Augmentation has not yet proven entirely successful with scattered records of propagated individuals found in returning surveys.

Citico darter (*E. sitikuense*):

Citico Creek - The Citico darter continues to be stable or increasing in Citico Creek (Rakes and Shute 2007) and remains the source population for reintroductions into the Tellico River (Petty et al. 2011). Eggs taken from nests in Citico Creek are used to propagate young for the reintroduction efforts into Citico Creek, Abrams Creek, and the Tellico River. In 2010, CFI stocked a total of 321 individuals into Citico Creek (Petty et al. 2011). In 2009 and 2010, 114 individuals and 35 nests were observed by CFI (Petty et al. 2011). In 2006, a total of 220 individuals and 24 nests were observed (Rakes and Shute 2007). From 1993-2002, annual abundance indices ranged from 2.0 to 7.85 fish per person-hour, and averaged 4.6 fish per person-hour (CFI 2003).

Abrams Creek - In 1992, CFI began captive propagation and reintroduction of what is now being described as the Citico darter into Abrams Creek, GRSM (Great Smoky Mountains), Blount County, Tennessee. Eggs taken from nests in nearby Citico Creek (isolated from Abrams Creek by Chilhowee and Tellico reservoirs) are used to propagate young for the reintroduction efforts. Between 1987 and 2003, a total of 3,430 Citico darters were stocked into Abrams Creek (Shute et al. 2005). Monitoring conducted during the same time period revealed 433 observations of Citico darters (Shute et al. 2005). Stocking was discontinued in 2001 in order to monitor the populations in Abrams Creek and evaluate the status of the reintroduced population. From 1993-2002, annual abundance indices ranged from 0.5 to 1.74 fish per person-hour, with an average of 1.0 fish per person-hour (CFI 2003).

In 2007, the average annual Citico darter abundance index was 12.1 fish per person-hour, the highest ever recorded (Rakes and Shute 2008). CFI has consistently observed evidence of natural reproduction in Abrams Creek since 1995 (Shute et al. 2005). Citico darters appear to be doing well above and below the Abrams campground area (Shute 2008, pers. comm.).

Citico darters have not been stocked into Abrams Creek since 2001. Given steady increases in annual abundance indices and an expanding distribution in Abrams Creek over the past seven years, this population appears to be viable (Rakes and Shute 2008). The Citico Creek population continues to be stable or increasing (Rakes and Shute 2007) and remains the source population for reintroductions into the Tellico River (Petty et al. 2011).

Tellico River - In 2002, CFI began captive propagation efforts for the now described Citico darter introductions within the Tellico River NEP. Eggs taken from nests in nearby Citico Creek were used to propagate young for the reintroduction efforts. From 2002 to 2010, a total of 3,547 duskytail darters were reintroduced into the Tellico River (Petty et al. 2011). Natural reproduction was observed at two reintroduction sites in 2007 (Rakes and Shute 2008) and there is now evidence of natural reproduction and successful recruitment of new year classes (Petty et al. 2011).

Tuxedo darter (*E. lemniscatum*):

Big South Fork of the Cumberland River - Tuxedo darters have consistently been found in the Big South Fork of the Cumberland River (BSF) since at least 1998. From 1993-2002, annual abundance indices ranged from 0.66 to 2.0 fish per person-hour, and averaged 1.3 fish per person-hour (CFI 2003). In 2005 surveys, CFI observed 28 individuals at three sites (CFI, field notes). Recent surveys have expanded the known range of the BSF population to a 22.5 kilometer (km) (14 mile (mi)) reach of the river (Davis 2010), with the core population between Station Camp Creek and Blue Heron on the mainstem of the river (CFI 2003). Davis (2010) estimated the total population size as approximately 200 in 2008, and approximately 100 in 2009. Ninety percent of tuxedo darters were found within a 7 km (4.3 mi) reach (Davis 2010).

Duskytail darter (*E. percnurum*):

Copper Creek and Clinch River -From 1993-2002, the duskytail darter was indirectly monitored while surveying for the yellowfin madtom in Copper Creek. During that time period, annual abundance indices in Copper Creek ranged from 0.33 to 2.22 fish per person-hour, with an average of 1.2 fish per person-hour (CFI 2003). In 2007, CFI observed 62 duskytail darters in Copper Creek above the VA 627 Bridge (CFI, field notes). In a 2008 survey focused on duskytail darters, CFI observed 98 duskytail darters from approximately 19 km (12 mi) of lower Copper Creek rkm 2.9 to 22.2 (rmi 1.8 to 13.8) (Rakes et al. 2009). In 2008, the duskytail darter numbers ranged from 0 to 8 fish per person hour, and the range of the fish appeared to have contracted in both an upstream and downstream direction when compared with earlier studies (Rakes et al. 2009). In 2009, CFI observed one duskytail darter at Copper Creek rkm 22.4 (mi 13.9) (CFI 2009, field notes). In 2002, CFI collected fin clip tissue samples from Copper Creek (as well as BSF and Citico Creek) for genetic comparison (CFI 2008). Genetic analyses have been initiated, but are not complete.

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.

Recovery task 1.3.1. Conduct life history research on the species to include such factors as reproduction, food habits, age and growth, and mortality. This recovery task notes that while Layman (1991) provided life history for the Little River population (marbled darter), other populations (species in the duskytail darter complex) warrant further research.

Citico Darter: Citico darter is reported to have limited dispersal ability (Gibbs 2009).

Tuxedo Darter: Davis et al. (2011a) conducted a mark-recapture study of Citico darters stocked into Abrams Creek and found that the dispersal of released Citico darters occurred within the first 20 hours after release. Capture efficiency was low and darter behavior following release made individuals susceptible to predation by large predatory fishes (Davis et al. 2011a). Davis et al. (2011a) recommends removing predators and blocking predators from the area with nets before stocking Citico darters into an area to allow fish to acclimate to their new surroundings. However, CFI recommends night-time releases and/or providing human induced fright to prompt stocked fish to seek cover in a timely manner (Rakes 2011, pers. comm.).

Recovery task 1.3.2. Characterize the species' habitat (relevant physical, biological, and chemical components) for all life history stages. This recovery

task has not been completed for all species in the duskytail darter species complex.

Citico Darter: Tennessee Technological University studies have characterized the macrohabitat (Gibbs 2009) and microhabitat (Miller 2011) of the Citico darter in Abrams Creek. Percentage of cobble substrate was the only significant habitat variable measured that influenced Citico darter presence, with reaches containing greater than 34 percent cobble having a greater than 50 percent probability of presence (Gibbs 2009). Citico darters inhabited all three reaches that were sampled and met this habitat criterion (> 34% cobble), and were therefore, considered fully recovered within the sampled reaches of Abrams Creek (Gibbs 2009). The probability of Citico darter presence increased as distance to bank increased and habitat type transitioned from riffle to run to pool (Miller 2011). Miller (2011) concluded that the presence of pool habitat was the greatest single habitat variable that influenced Citico darter presence in Abrams Creek.

Tuxedo Darter: Davis (2010) characterized the summer microhabitat of the tuxedo darter to include depths between 20-80 centimeters (cm) (7.9-31 inches (in)), velocities less than 0.1 meter/second (m/s) (0.3 feet/second (ft/s)), and cover rocks with a surface area of 200-1400 cm² (30-217 in²). The probability of tuxedo darter presence at a site increased with available cobble substrate and shallow pool habitat (Davis 2010).

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

This criterion has not been met. Water quality is declining in the Little River and its tributaries due to nonpoint source pollution from agricultural, municipal, and development sources (CFI 2004). In June 2008, a car accident resulted in a gas spill that affected a small portion of Citico Creek in the CNF. The accident occurred approximately 3.2 km (2 mi) upstream from designated critical habitat for the smoky madtom, and no take was recorded for rare fish species. The accident serves as a reminder that Citico Creek is paralleled by a road where toxic spills can occur. The BSF and its tributaries are impacted by forestry practices, municipal and domestic waste, agricultural runoff, oil and gas operations, and water withdrawal. In particular, the New River drainage has recently had an increase in the level of coal mining activity. The Clinch River and Copper Creek are impacted by nonpoint source pollution from coal mining and agriculture, in particular in stream livestock activity and loss of riparian vegetation. Visitors to the GRSM Abrams Creek Campground area continue to build rock dams and channelize the river with large stones. Gibbs (2009) reported that Citico darters were not affected by stream alteration due to human disturbance (construction of rock dams within a riffle below Abrams Creek campground) because Citico darters were not observed in the altered riffle habitat during the study. However, these dams potentially remove cover rocks needed for successful spawning. In the upper Tellico River, off highway vehicle (OHV) use

in designated areas of the Nantahala National Forest (NNF) threatened water quality and rare fish habitat. The U.S. Forest Service (FS) closed all trails to prevent water quality problems associated with OHV use.

Criteria necessary to delist the duskytail darter (*Etheostoma percnurum*) have not been met yet, but are presented here for reference.

1. Through protection and enhancement of the existing population and successful establishment of reintroduced populations or the discovery of additional populations, five distinct viable populations exist.
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 successful.
3. No foreseeable threats exist that would likely threaten the survival of any of the populations.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends, demographic features or demographic trends:

Information on biology and habitat of the Little River population of duskytail darter (marbled darter) is summarized in the Recovery Plan (USFWS 1994). A comparison of the egg and larval development of the BSF population of duskytail darters (tuxedo darter) to other species in the *Etheostoma flabellare* group can be found in Simon and Layman (1995).

In 1993, the duskytail darter was known to occupy about 15 km (9 mi) of the Little River, 4.4 km (2.6 mi) of Citico Creek, 29 km (17 mi) of Copper Creek, and only one site in the BSF.

Marbled Darter: Due to declines, the species was augmented in the Little River without measurable success yet. However, the three known occupied areas appear to be relatively stable through early 2011 (Rakes 2011, pers. comm.).

Citico Darter: In Citico Creek, the population has remained relatively stable for over 10 years. The species has been reintroduced into Abrams Creek and has remained relatively stable for over 7 years. The Citico darter has also been reintroduced into the Tellico River, and is naturally reproducing with evidence of recruitment to the population following annual stocking efforts that began in 2002.

Tuxedo Darter: The tuxedo darter now occupies at least 22.5 km (14 mi) of the river. Davis (2010) estimated the statistical power of differing monitoring protocols to detect trends in the tuxedo darter populations in the Big South Fork National River and Recreation Area. In order to detect a 10 percent decline at a relevant power with a Type I error rate of $\alpha = 0.10$, at least 14 years of annual monitoring data are required (Davis 2010). As an undetected 10 percent decline over a period of more than 10 years could result in the extinction of a small population, Davis (2010) recommended an adaptive management strategy to evaluate population viability after a shorter time period (3-5 years). Monitoring must employ an efficient sampling design and standardized monitoring protocols. Davis (2010) recommended monitoring a network of sites, using a simple random sampling procedure, and collecting count data (abundance) as the variable for quantitative estimates of population size for the tuxedo darter. This study was used to develop a draft long-term monitoring protocol for the tuxedo darter in the Big South Fork of the Cumberland River (Davis et al. 2011b). The protocol has not yet been implemented in the Big South Fork National River and Recreation Area. A similar protocol is being developed for the Citico Darter within the Great Smoky Mountains National Park (Kulp 2011, pers. comm.).

Duskytail Darter: The duskytail darter occupies approximately 19 km (12 mi) of Copper Creek. In 2008, the duskytail darter numbers ranged from 0 to 8 fish per person hour, and the range of the fish appeared to have contracted in both an upstream and downstream direction when compared with earlier studies (Rakes et al. 2009). Rakes et al. (2009) provides recommended monitoring methods and sites for continued monitoring of the species.

b. Genetics, genetic variation, or trends in genetic variation:

Genetic monitoring of the Citico darter is currently underway to estimate and compare genetic diversity between the Citico and Abrams creek populations. Initial analyses show that Citico Creek populations have significantly more genetic diversity than Abrams Creek populations (Moyer 2011, pers. comm.).

No new information exists concerning the within population genetic variation of the marbled darter, tuxedo darter, or duskytail darter.

c. Taxonomic classification or changes in nomenclature:

The duskytail darter was recognized as *Etheostoma* (*Catonotus*) sp. at the time the Recovery Plan was written in 1993. Later regulatory documents use *Etheostoma percnurum* Jenkins (Jenkins and Burkhead 1994) as the recognized classification of the duskytail darter (Nelson et al. 2004).

In 2008, Blanton and Jenkins described three new morphologically diagnosable species. These descriptions were based on the examination of meristic, morphometric, and pigmentation analyses that showed substantial variation among the four duskytail darter populations (Copper Creek, BSF, Citico Creek, and Little River) (Blanton and Jenkins 2008). The Copper Creek population remains the duskytail darter, *E. percnurum* (Clinch River system, Tennessee River drainage); the Citico darter (*E. sitikuense*) is described from Citico Creek, Abrams Creek, and Tellico River in the Tennessee River system; the Marbled darter (*E. marmorpinnum*) is described from the Little River and South Fork Holston River in the Tennessee River system; and the Tuxedo darter (*E. lemniscatum*) is described from the Big South Fork of the Cumberland River (Blanton and Jenkins 2008). For a complete comparison of meristic, pigmentation, and morphometric diagnostic features for the four species in the duskytail darter species complex, see Table 8 of Blanton and Jenkins (2008, p. 13). Morphological, molecular and ecological data further support separate species status of the BSF population (Eisenhour and Burr 2000, Wood et al. 2003).

The newly described taxa (Blanton and Jenkins 2008) will also be recognized in the next edition of the “Common and scientific names of fishes from the United States, Canada, and Mexico. . .” (Page 2011, pers. comm.). Based on the best available information, the Service believes the original listing of duskytail darter should be reevaluated under the Act in consideration of the accepted work of Blanton and Jenkins (see section IV. Future Recommendations).

d. Spatial distribution, trends in spatial distribution, or historic range:

Marbled Darter: The marbled darter is currently restricted to 14.5 rkm (9 rmi) of the lower Little River in Blount County, Tennessee (Blanton and Jenkins 2008).

Citico Darter: The Citico darter is currently restricted to approximately 9.3 rkm (5.75 rmi) of Citico Creek in Monroe County, Tennessee (Rakes 2011, pers. comm.). The species has been propagated and reintroduced into Abrams Creek and the Tellico River using Citico Creek stock (see Section B.3.). The Citico darter is currently restricted to 4 rkm (2.5 rmi) of Abrams Creek in Blount County, Tennessee (Gibbs 2009). The Citico darter reintroductions into Tellico Creek are restricted to 3.2 rkm (2 rmi) in Monroe County, Tennessee (Petty et al. 2011).

Tuxedo Darter: Recent surveys have expanded the known range of the BSF population to a 22.5 km (14 mi) reach of the river (Davis 2010), with

the core population between Station Camp Creek and Blue Heron on the mainstem of the river (CFI 2003). Suitable habitat within the river is separated by distances greater than 1 km (0.6 mi), and it is unknown whether or not the tuxedo darter is able to disperse across pool barriers (Davis 2010).

Duskytail Darter: The duskytail darter is currently restricted to 19 rkm (12 rmi) of the Copper Creek tributary to the Clinch River in Scott County, Tennessee (Rakes et al. 2009).

e. Habitat:

Marbled Darter: Municipal water withdrawals by the cities of Maryville and Alcoa, TN, and agricultural inputs of sediment into the Little River potentially threaten the marbled darter (Rakes 2009, pers. comm.).

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.

Tuxedo Darter: Davis (2010) characterized the microhabitat use of the tuxedo darter. The tuxedo darter uses slow-flowing, shallow areas with an abundance of cobble or boulder-sized cover rocks (Davis 2010). These areas have been described as glides. The tuxedo darter range in the Big South Fork is limited to a small section of the mainstem of the river (Davis 2010). Suitable habitat within the river is separated by distances greater than 1 km (0.6 mi), and it is unknown whether or not the tuxedo darter is able to disperse across pool barriers (Davis 2010).

Duskytail Darter: Agriculture continues to impact duskytail darter habitat in Copper Creek based on Service observations.

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

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

As indicated in the Recovery Plan (USFWS 1994), impoundment, water withdrawal, urbanization, coal mining, toxic chemical spills, siltation, improper pesticide use, and streambank erosion remain threats to the duskytail darter species complex.

Physical habitat destruction resulting from a variety of human-induced impacts such as siltation, disturbance of riparian corridors, and changes in channel morphology continues to plague the Tennessee and Cumberland River systems. The most significant of these impacts is siltation caused by excessive releases of sediment from activities such as agriculture, resource extraction (e.g., coal mining, silviculture), road construction, and urban development (Waters 1995). Activities that contribute sediment discharges into a stream system change the erosion or sedimentation pattern, which can lead to the destruction of riparian vegetation, bank collapse, excessive instream sediment deposition, and increased water turbidity and temperatures.

Sediment has been shown to abrade and or suffocate bottom-dwelling organisms by clogging gills; reducing aquatic insect diversity and abundance; impairing fish feeding behavior by altering prey base and reducing visibility of prey; impairing reproduction due to burial of nests; and, ultimately, negatively impacting fish growth, survival, and reproduction (Waters 1995). Wood and Armitage (1997) identified at least five impacts of sedimentation on fish, including (1) reduction of growth rate, disease tolerance, and gill function; (2) reduction of spawning habitat and egg, larvae, and juvenile development; (3) modification of migration patterns; (4) reduction of food availability through the blockage of primary production; and (5) reduction of foraging efficiency. The effects of these types of threats will likely increase as human populations grow in the Tennessee and Cumberland River systems in response to human demands for water, housing, transportation, and places of employment.

Non-point source pollution from land surface runoff can originate from virtually any land use activity (such as coal mining and agricultural activities) and may be correlated with impervious surfaces and storm water runoff from urban areas. Pollutants entering the Tennessee and Cumberland River systems may include sediments, fertilizers, herbicides, pesticides, animal wastes, pharmaceuticals, septic tank and gray water leakage, and petroleum products. These pollutants tend to increase concentrations of nutrients and toxins in the water and alter the chemistry of affected streams such that the habitat and food sources for species like the duskytail darter are negatively impacted.

Marbled Darter: Municipal water withdrawals by the cities of Maryville and Alcoa, TN, and agricultural inputs of sediment into the Little River potentially threaten the marbled darter (Rakes 2009, pers. comm.).

Citico Darter:

In June 2008, a car accident resulted in a gas spill that affected a small portion of Citico Creek in CNF in close proximity to where the Citico

darther is known to exist. The accident serves as a reminder that Citico Creek is paralleled by a road where toxic spills can occur. Visitors to the GRSM Abrams Creek Campground area continue to build rock dams and channelize the river with large stones. Gibbs (2009) reported that Citico darters were not affected by stream alteration due to human disturbance (construction of rock dams within a riffle below Abrams Creek campground) because Citico darters were not observed in the altered riffle habitat during the study.

Tuxedo Darter:

The duskytail darter continues to be threatened by coal mining activities and oil and gas exploration in the Big South Fork of the Cumberland River. The downstream range may be limited by tributaries containing acid mine drainage (Davis 2010). Habitats can be impacted by activities such as coal mining and logging, which alter flow regimes and increase sedimentation rates (Davis 2010).

Duskytail Darter:

Common land uses within the Clinch-Powell watershed include urban, industrial, commercial, and residential development; livestock production; agricultural cropping including tobacco and corn; coal mining, reclaimed coal mined lands, and “abandoned” coal mined lands (i.e., lands affected by mining prior to the federal law that were not reclaimed properly); road and railroad networks; and silvicultural practices (US EPA 2002). These land use activities act as sources of stress to the duskytail darter by contributing sediment and contaminants into the watershed.

Coal mining activity is occurring in the upper Clinch River watershed in Virginia, and coal fines in the upper river are moving downstream into Tennessee. A 585-megawatt coal powered electric generation facility is expected to be constructed along the Clinch River in Virginia City, Wise County, Virginia. Effluent discharge, run-off from fly ash storage, and other sources related to the operation of the facility could represent new threats to the Clinch River.

Agriculture continues to threaten the duskytail darter in Copper Creek. The Service along with The Nature Conservancy, local Soil Conservation Districts, the Natural Resources Conservation Service, Farm Service Agency, Clinch-Powell Resource Conservation and Development Council, and many State agencies and local partners are working together to protect aquatic biodiversity in the Clinch-Powell watershed by providing monetary assistance in the form of cost-share programs to facilitate the protection and recovery of riparian corridors and the reduction and prevention of non-point source pollution on private lands.

b. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization is not thought to be a threat to the duskytail darter species complex, including the marbled, Citico, tuxedo, or duskytail darter.

c. Disease or predation:

Disease is not thought to be a threat to the duskytail darter species complex (marbled, Citico, tuxedo, or duskytail darter). However, predation from larger catfish species could be a factor in the lack of success seen in recent Tellico River reintroductions of the Citico darter.

d. Inadequacy of existing regulatory mechanisms:

The marbled darter, Citico darter, tuxedo darter, and duskytail darter and their habitats are afforded limited protection from water quality degradation under the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.) and the Tennessee Water Quality Control Act of 1977. 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.

In addition to the federal listing, the duskytail darter is listed as Endangered by the State of Tennessee. Under the Tennessee Nongame and Endangered or Threatened Wildlife 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, process, sell or offer for sale or ship nongame wildlife, or for any common or contract carrier knowingly to transport or receive for shipment nongame wildlife." Further, regulations included in the Tennessee Wildlife Resources Commission Proclamation 00-15 Endangered Or Threatened Species state the following: except as provided for in Tennessee Code Annotated, Section 70-8-106 (d) and (e), it shall be unlawful for any person to take, harass, or destroy wildlife listed as threatened or endangered or otherwise to violate terms of Section 70-8-105 (c) or to destroy knowingly the habitat of such species without due consideration of alternatives for the welfare of the species listed in (1) of this proclamation, or (2) the United States list of Endangered fauna. Potential collectors of this species would be required to have a state collection permit.

Since listing, section 7 of the Act has required Federal agencies to consult with the Service when projects they fund, authorize, or carry out may affect the species. However, the lack of Federal authority or nexus over the many actions likely impacting duskytail darter habitat has become apparent. Many of the threats (including those identified at the time of listing, during recovery planning, and since development of the Recovery Plan) involve activities that likely do not have a Federal nexus (such as

water quality changes resulting from development, water withdrawals, or logging) and, thus, may not result in section 7 consultation. Although the take prohibitions of section 9 of the Act do apply to these types of activities and their effects on the duskytail darter, enforcement of the section 9 prohibitions is difficult. The Service is not informed when many activities are being considered, planned, or implemented; therefore, we have no opportunity to provide input into the design of the project or to inform project proponents of the need for a section 10 permit.

Duskytail Darter: In response to increasing concern over impacts to freshwater mussels from coal mining in the Clinch River watershed, Regions III and IV of the USEPA, TDEC, VDEQ, and VDMME signed an MOU to establish a working group for improving communications and coordinating efforts to protect and restore the Clinch and Powell Rivers. These agencies and others have demonstrated an interest in working together to accomplish common goals of reducing human impacts associated with coal mining and processing, agriculture, urbanization, and the development of transportation corridors.

In 2008, a Clinch-Powell Science Plan Work Group was developed to prepare a preliminary and draft “Biodiversity Conservation Science Plan for the Clinch-Powell River System, Virginia – Tennessee, USA” for the Clinch-Powell Symposium Steering Committee and the Clinch-Powell MOU Working Group. The plan proposes to generate scientific information that can be used to aid biodiversity conservation in the Clinch-Powell system. Specifically, studies to characterize and quantify contaminant levels in the Clinch and Powell rivers will help landowners, land managers, and regulatory agencies to make decisions regarding the conservation of federally listed and other sensitive species.

e. Other natural or manmade factors affecting its continued existence:

The marbled darter, Citico darter, tuxedo darter, and duskytail darter have limited geographic ranges and small population sizes, leaving the species extremely vulnerable to localized extinctions from accidental toxic chemical spills or other stochastic disturbances and to decreased fitness from reduced genetic diversity. 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.

The marbled darter, Citico darter, tuxedo darter, and duskytail darter are vulnerable to losses in genetic diversity and fitness due to small population sizes. 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).

D. Synthesis

The duskytail darter was historically located in the Little River, Citico Creek, BSF, Copper Creek, Clinch River, Abrams Creek, and South Fork Holston River. At the time the recovery plan was written (USFWS 1994), the species was extirpated from Abrams Creek and South Fork Holston River. Since that time, CFI has successfully reintroduced the duskytail darter into Abrams Creek. Augmentation efforts are being conducted by CFI in the Little River and populations have remained generally stable. Populations in Citico Creek and BSF also appear to be stable. Recent collections in Copper Creek show that this population can be consistently observed in these rivers, but a thorough status survey is still needed. The species has been introduced into Tellico River, and there is evidence of natural reproduction and successful recruitment of new year classes into the Tellico River.

Given the ongoing threats to the duskytail darter from coal mining, oil and gas exploration, agriculture, and recreational activities; and the restricted range of the duskytail darter complex; the species continues to be in danger of extinction throughout its range. Therefore, the status of the duskytail darter listed as endangered remains appropriate. The Service recommends that the three new species in the duskytail darter species complex be evaluated for consideration for listing under the Act.

In the 2007 RDC, 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. The duskytail darter has shown a high recovery potential. Therefore, we recommend the recovery priority number remain a 2 for the duskytail darter at this time.

III. RESULTS

A. Recommended Classification:

 X No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

We recommend that the duskytail darter complex described by Blanton and Jenkins for consideration regarding listing status of each species in the complex.

Marbled Darter:

Continue to monitor population levels and habitat conditions of presently established populations as well as introduced and expanding populations.

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.

Continue to utilize existing legislation and regulations (Federal Endangered Species Act, Federal and State surface mining laws, water quality regulations, stream alteration regulations, Federal Energy Regulatory Commission licensing, etc.) to protect the fish and its habitats.

Continue efforts to reduce non-point source pollution from agricultural activities by working through the Partners for Fish and Wildlife, Farm Bill, and other landowner incentive programs to implement best management practices.

Citico Darter:

Continue to monitor population levels and habitat conditions of presently established populations as well as introduced and expanding populations.

Evaluate recent habitat studies and suggested reintroduction practices and habitats before continuation of reintroduction/augmentation of the species into Abrams Creek and the Tellico River (Gibbs 2009, Davis 2010, Miller 2011). During future reintroduction efforts, stock darters in the most upstream extent of pool habitats (Miller 2011).

Continue genetic analyses comparing diversity within and among Citico darter populations. Evaluate results of studies by Dr. Moyer, and incorporate into a propagation plan for the species.

Continue to utilize existing legislation and regulations (Federal Endangered Species Act, Federal and State surface mining laws, water quality regulations, stream alteration regulations, Federal Energy Regulatory Commission licensing, etc.) to protect the fish and its habitats.

Continue efforts to reduce non-point source pollution from agricultural activities by working through the Partners for Fish and Wildlife, Farm Bill, and other landowner incentive programs to implement best management practices.

Tuxedo Darter:

Continue to monitor population levels, within population genetic diversity, and habitat conditions of presently established populations as well as introduced and expanding populations.

Continue to utilize existing legislation and regulations (Federal Endangered Species Act, Federal and State surface mining laws, water quality regulations, stream alteration regulations, Federal Energy Regulatory Commission licensing, etc.) to protect the fish and its habitats.

Continue efforts to reduce non-point source pollution from agricultural activities by working through the Partners for Fish and Wildlife, Farm Bill, and other landowner incentive programs to implement best management practices.

Duskytail Darter:

Revise the current Recovery Plan to reflect the current status of the species' knowledge and to add threats based recovery criteria.

Continue to monitor population levels and habitat conditions of presently established populations as well as introduced and expanding populations.

Characterize the species' habitat (relevant physical, biological, and chemical components) for all life history stages.

Continue to monitor the Clinch River to determine species presence or absence in the river. Conduct within population genetic analyses to determine level of diversity. Consider propagation and reintroduction into the Clinch River. If propagation is found warranted, prepare a propagation plan for the species.

Continue to utilize existing legislation and regulations (Federal Endangered Species Act, Federal and State surface mining laws, water quality regulations, stream alteration regulations, Federal Energy Regulatory Commission licensing, etc.) to protect the fish and its habitats.

Continue efforts to reduce non-point source pollution from agricultural activities by working through the Partners for Fish and Wildlife, Farm Bill, and other landowner incentive programs to implement best management practices.

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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 Stephanie Chance, Tennessee Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Mary E. Jennings Date 4/26/12

REGIONAL OFFICE APPROVAL:

for **Lead Regional Director, Fish and Wildlife Service**

Approve John Mize Date 6/20/12

for **Cooperating Regional Director, Fish and Wildlife Service**

☒ Concur ☐ Do Not Concur

Signature Spencer Simon Date 7/27/12

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

- A. Peer Review Method: On July 31, 2008, an email was sent to biologists from CFI, CNF, NPS, TVA, VDGIF, and Dr. Rebecca Blanton Johansen asking for peer review of the draft yellowfin madtom, smoky madtom, and duskytail darter 5 year review. These individuals are considered to be species experts.
- 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 CNF, TVA did not respond back with comments on the review. Conservation Fisheries, Inc., NPS, and VDGIF responded with minor edits. Dr. Johansen responded back with information on the duskytail darter species complex.
- D. Response to Peer Review – Peer reviewer edits were incorporated into the revised document. In addition, the results of several research projects were incorporated into the document. 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.