

**Yellowfin Madtom (*Noturus flavipinnis*)**  
**Smoky Madtom (*Noturus baileyi*)**

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



**Yellowfin Madtom, photo by CFI**



**Smoky Madtom, photo by CFI**

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

**5-YEAR REVIEW**  
**Yellowfin Madtom (*Noturus flavipinnis*)**  
**Smoky Madtom (*Noturus baileyi*)**

**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 these species. Our sources include the final rule listing these species under the Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts.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 lead recovery biologist for this species conducted the review. The public notice for this review was published in the *Federal Register* on July 28, 2006, with a 60-day public comment period.

**B. Reviewers**

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

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

**Lead Field Office – Cookeville, TN, Ecological Services:** Stephanie Chance, 931-525-4981

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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:**

Yellowfin Madtom (*Noturus flavipinnis*): Stable, 2011 Recovery Data Call

No new information is available to indicate that threats have increased over the past year. Based on snorkel surveys conducted by Conservation Fisheries, Inc. (CFI), Citico Creek populations appear to be stable. CFI data also shows successful recruitment of new year classes in the Tellico River. There are no population trend data for the species over the past year.

Smoky Madtom (*Noturus baileyi*): Stable, 2011 Recovery Data Call

No new information is available to indicate that threats have increased over the past year. Based on snorkel surveys conducted by CFI, Abrams and Citico Creek populations appear to be stable. CFI data also shows successful recruitment of new year classes in the Tellico River. There are no population trend data for the species over the past year.

**3. Recovery achieved:** Yellowfin Madtom (*Noturus flavipinnis*): 2 (26-50% recovery objectives achieved); Smoky Madtom (*Noturus baileyi*): 2

**4. Listing history**

Original Listing

Yellowfin Madtom (*Noturus flavipinnis*)

FR notice: 42 FR 45526

Date listed: September 9, 1977

Entity listed: Species

Classification: Threatened

Smoky Madtom (*Noturus baileyi*)

FR notice: 49 FR 43065

Date listed: October 26, 1984

Entity listed: Species

Classification: Endangered

**5. Associated rulemakings:**

Yellowfin Madtom (*Noturus flavipinnis*)

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.

August 4, 1988. Determination of Nonessential Experimental Population Status for Introduced Population of Yellowfin Madtom in VA & TN. 53 FR 29335.

Smoky Madtom (*Noturus baileyi*)

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

**6. Review History:**

Yellowfin Madtom (*Noturus flavipinnis*)

Final Recovery Plan, 1983

Recovery Data Call, 1998-2011

Smoky Madtom (*Noturus baileyi*)

Final Recovery Plan, 1985

Recovery Data Call, 1998-2011

A previous 5-year review for both these species was noticed on November 6, 1991 (56 FR 56882). In this review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors, threats, etc. as they pertained to the individual species. The notices summarily listed these species and stated that no changes in the designation of these species were warranted at that time. In particular, no changes were proposed for the status of these species in the review.

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

Yellowfin Madtom (*Noturus flavipinnis*): 11. The "11" indicates a moderate degree of threat and a low recovery potential.

Smoky Madtom (*Noturus baileyi*): 5

The "5" indicates a high degree of threat and low recovery potential.

**8. Recovery Plan:**

Yellowfin Madtom (*Noturus flavipinnis*) Recovery Plan

Final Recovery Plan, 1983

Smoky Madtom (*Noturus baileyi*) Recovery Plan

Final Recovery Plan, 1985

**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 (for both fishes)**
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? Yes (for both fishes)**
  - b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes (for both fishes)**
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.**

## **Yellowfin madtom**

Criteria necessary to consider the yellowfin madtom (*Noturus flavipinnis*) for delisting include:

1. Through protection of existing populations and/or by introductions and/or discoveries of new populations there exist viable populations in the Powell River, Copper Creek, and Citico Creek of the following magnitude:
  - a. Powell River (Claiborne and Hancock Counties, Tennessee; Lee County, Virginia) – A minimum of five population centers exist from the backwaters of Norris Reservoir upstream to approximately river kilometer (rkm) 189.3 (118 miles (mi)). These populations are dispersed throughout this river reach so that it is unlikely that a single event would cause the loss of the entire population.
  - b. Copper Creek (Scott County, Virginia) – The species is widely distributed from the creek's mouth to rkm 50 (31.1 mi).
  - c. Citico Creek (Monroe County, Tennessee) – The species is widely distributed throughout its preferred habitat within the creek.

Viable populations are defined in the recovery plan as ten years of population monitoring (biannual sampling) indicates that the species is reproducing and that the population is either stable or expanding. Due to the difficulty of sampling yellowfin madtoms in the Powell River, the collection of one individual at each of the five population centers on three occasions over ten years would constitute viability for the Powell River population.

Population center is defined as a single or grouping of sites which contain yellowfin madtoms in such close proximity that the individual fish can be considered as belonging to a single breeding unit.

Powell River – This criterion has not been fully met; we do not have collections of one individual at five population centers on three occasions over a ten year period (see definition of viable populations for the Powell River above). From 2000 to 2003, Conservation Fisheries, Inc. (CFI) discovered yellowfin madtoms at three new sites in the Powell River, giving a range spanning over 40 rkm (25 mi) (Rakes and Shute 2003) (Table 1). In 2007, one individual was recorded from a site at rkm 236 (146.7 mi) following stocking efforts conducted the previous year (Rakes and Shute 2007). Later in 2007, reproducing individuals were seen at the site (Rakes and Shute 2007, field notes). From 2006 to 2009, a total of 492 individuals were released from approximately Powell River km 235-237 (146-147 rmi) (CFI 2009, field notes).

Data reported in Table 1, represent the collection of one individual at each of five sites (population centers) on one or two occasions. Therefore, the criterion that the collection of one individual at each of the five population centers on three occasions over ten years would constitute viability for the Powell River population has not been fully met.

Table 1. Powell River “population center” monitoring results. Adapted from data presented in Rakes and Shute 2003, 2007, and 2007 field notes.

<b>Location</b>	<b>Date</b>	<b>No. Observed</b>	<b>No. Released</b>
<b>Buchanan Ford</b>	2000	1	
<b>PRM 99.2</b>	2001	1	
	2006	1	
<b>Above Buchanan Ford</b>	2006	9	
<b>PRM 99.3</b>			
<b>Brooks Bridge</b>	2001	1	
<b>PRM 95.1</b>	2002	2	
<b>Above Brooks Bridge</b>	2006	10	
<b>PRM 95.3</b>			
<b>Mulberry Creek</b>	2001	2	
<b>PRM 103.3</b>			
<b>Co Rd 833</b>	2002	1	
<b>PRM 120.3</b>	2006	1	
	2009	18	
<b>Above VA 833 bridge</b>	2006/07	13	
<b>PRM 120.7</b>	2006/07	5	
<b>Hall Ford</b>	2006	11	
<b>PRM 128.4</b>	2007	16	
<b>VA 783 Bridge</b>	2006	1	206
<b>PRM 146.7</b>	2007		77
	2009	2	102
<b>Above Laurel Branch</b>	2009		107
<b>PRM 147.1</b>			

Copper Creek – This criterion has not been met, however, we are working with partners to expand the range of yellowfin madtoms in Copper Creek. In 1998, CFI found 49 individuals between Copper Creek km 2.7-2.9 and 22.2-24.8 (1.7-1.8 and 13.8-15.4 mi) (Pinder 2008, pers. comm.). Eggs from two nests were collected to be reared in captivity. In 2000, CFI released captive-raised yellowfin madtoms at creek km 55.8 (34.7mi), reintroducing and expanding the range of the species. In 2007, CFI collected eggs from three nests producing 169 young for release at Copper Creek km 55.8 (34.7 mi) (Pinder 2008, pers. comm.). In 2008, 136 young were released at rkm 64.4 (40.0 mi) (Rakes and Shute 2008a) and CFI conducted surveys and habitat assays to evaluate other sites for potential reintroduction efforts. In 2009, a total of 127 juveniles were released at the VA 682 Bridge (Petty and Rakes 2010). One individual with a nest was observed at Copper Creek rkm 28.3 (rmi 17.6), one individual was observed at rkm 20 (12.5 rmi), 15 individuals with 2 nests were seen at rkm 22.4 (13.9 rmi), 10 individuals with 3 nests were seen at rkm 22.5 (13.95 rmi), and 7 individuals were seen at rkm 64.4 (rmi 40) (CFI 2009, field notes). The upper reaches of Copper Creek have better habitat than the middle reaches of the creek and are less impacted by adjacent land use practices (Rakes and Shute 2008a). Since yellowfin madtom already occur in the lower reaches of the creek, efforts were focused in the uppermost reaches of Copper Creek. Yellowfin madtoms are also thought to disperse primarily downstream (Dinkins and Shute 1996), so re-establishing a population upstream will likely lead to a wider population base in the downstream reaches (Rakes and Shute 2008a).

Citico Creek – This criterion has been met. The distribution of yellowfin madtoms in Citico Creek has increased from the 3.6 km (2.2 mi) stretch (creek km 13.8 to 17.4) (8.6-10.8 mi) inhabited at the time of listing to a 6 km (3.7 mi) reach. This expansion is primarily the result of augmentation efforts implemented by CFI. The yellowfin madtom now inhabits the 6 km (3.7 mi) reach of Citico Creek from km 11.3 to 17.3 (7-10.7 mi), including locals downstream from the dam at creek km 13.8 (8.6 mi). Average annual abundance indices for 20 years of monitoring data show an increasing trend for the species in Citico Creek (Rakes and Shute 2008b). The yellowfin madtom has been successfully reproducing and dispersing since at least 2000 in Citico Creek, as demonstrated by the presence of wild spawned individuals outside of stocked locations.

2. Through introductions and/or discoveries of new populations, there exist viable populations in two other rivers within the species' historic range. These populations should be at least as large as the smallest population in the aforementioned rivers.

This criterion has not been met; however, we are working with partners to expand the range of the species in Abrams Creek and Tellico River, and the species has been discovered in the Clinch River since the recovery plan was written.

The Service has designated nonessential experimental population (NEP) status for the yellowfin madtom in the North Fork Holston River watershed in Washington, Smyth, and Scott Counties, Virginia; Tellico River, Monroe County, Tennessee; and in the lower French Broad and Holston rivers, Knox, Sevier, Grainger, and Jefferson counties, Tennessee (50 CFR 17.84, 53 FR 29335, 67 FR 52420, and 71 FR 34195). These NEPs allow for the reintroduction of the yellowfin madtom into these areas of its historical range. Yellowfin madtoms have not been reintroduced into the North Fork Holston River NEP or the lower French Broad and Holston Rivers NEP at this time. In 2009, CFI surveyed three sites in the North Fork Holston River in Washington County, Virginia to conduct habitat assessments and survey for the yellowfin madtom (CFI 2009, field notes). The species appears to be absent from the river, but there is no clear genetic source population for captive propagation and reintroduction efforts. More studies are needed to determine whether or not reintroductions would be a valid recovery option in the North Fork Holston River.

Abrams Creek – In 1986, CFI began captive propagation of the yellowfin madtom for stocking into Abrams Creek, Great Smoky Mountains National Park (GRSM), Blount County, Tennessee. Eggs taken from nests in nearby Citico Creek (isolated from Abrams Creek by Chilhowee and Tellico reservoirs) were used to propagate young for the reintroduction efforts. In an effort to maximize genetic variation within the reintroduced population, the following precautions were made: 1) Collections were done at different times of the year; 2) nests collected for captive propagation were collected throughout their known range in Citico Creek; 3) reintroduced populations were supplemented by multiple, semi-annual stockings; and 4) wild-collected individuals were added to captive spawning groups, more or less annually (Shute et al. 2005). Cooperators for this reintroduction effort include the Service, Tennessee Wildlife Resources Agency (TWRA), Cherokee National Forest (CNF), North Carolina Wildlife Resources Commission (NCWRC), National Park Service (NPS), GRSM, ALCOA, and the Tennessee Aquarium (Rakes and Shute 2008a).

Between 1986 and 2003, a total of 1,574 yellowfin madtoms were stocked into Abrams Creek (Shute et al. 2005). Monitoring conducted during the same time period revealed 74 observations of yellowfin madtoms (Shute et al. 2005). Stocking was discontinued in 2004 in order to monitor the populations in Abrams Creek and evaluate the status of the reintroduced population. Since 2004, populations have been monitored annually. Average annual yellowfin madtom abundance indices have fluctuated around 0.5 fish per person-hour or fewer since about 1994 (Rakes and Shute 2008a). CFI has observed periodic evidence of natural reproduction in Abrams Creek since 1995 (Shute et al. 2005). Yellowfin madtoms appear to be doing well in the lower section of Abrams creek [between the confluence at Chilhowee Lake and 1.6 rkm (1 rmi)] (Shute 2008, pers. comm.).

Tellico River Nonessential Experimental Population (NEP) – In 2002, CFI began captive propagation efforts for yellowfin madtom reintroduction within the Tellico River NEP. Eggs taken from nests in nearby Citico Creek (isolated from Abrams Creek by Chilhowee and Tellico reservoirs) have been used to propagate young for the reintroduction efforts. Cooperators include the Service, TWRA, CNF, NCWRC, NPS, GRSM, ALCOA, and the Tennessee Aquarium (Rakes and Shute 2005).

From 2002 to 2010, a total of 1,935 yellowfin madtoms were reintroduced into the Tellico River (Petty et al. 2011). Post-reintroduction monitoring has revealed the presence of only a few yellowfin madtoms, indicating that the population has not been established successfully yet (Rakes and Shute 2008a). Channel catfish have been observed in restoration sites on the Tellico River and might be a predator of yellowfin madtoms occupying the same habitat (Rakes and Shute 2007).

Clinch River – Yellowfin madtoms were considered extirpated from the Clinch River at the time the recovery plan was written; however, in 2004, the species was discovered at several sites spanning approximately 45.1 km (28 mi) in the upper Clinch River (Pinder 2008, pers. comm.). During recent surveys and habitat assays within the historic range of the species, the yellowfin madtom has been observed at 8 sites in the Clinch River between rkm 418 and 464 (260 and 288.4 mi) (Rakes and Shute 2006; Rakes and Shute 2008c). In 2007, CFI collected two adults just below American Electric Power’s Clinch River Plant at rkm 430 (267.3 mi) and one juvenile approximately 1.6 km (1 mi) above the plant (Rakes and Shute 2008c). In the same year, CFI collected 3 juvenile yellowfin madtoms in surveys conducted at Pucketts Hole rkm 464 (288.4 mi) (Rakes and Shute 2008d).

North Fork Holston River (NEP population) – CFI has received funding from VDGIF and the Service to assess the upper North Fork Holston River, Smyth County, Virginia. In 2008 to 2009, CFI will assess habitat in the river, conduct surveys for yellowfin madtoms, and locate possible reintroduction sites. According to CFI (Rakes and Shute 2003), Big Moccasin Creek, Scott and Russell counties, Virginia also warrants additional surveys.

3. Noticeable improvements in coal-related problems and substrate quality have occurred in the Powell River.

This criterion has not been met. In response to increasing concern over impacts to freshwater mussels from coal mining in the Clinch River watershed, Regions III and IV of the U.S. Environmental Protection Agency (USEPA), the Tennessee Department of Environment and Conservation (TDEC), the Virginia Department of Environmental Quality (VDEQ), and the Virginia Department of Mines, Minerals, and Energy (VDMME) signed a Memorandum of Understanding (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. As of late summer 2011, this plan has still not been fully implemented.

4. The species and its habitat in all five rivers are protected from present and foreseeable human related and natural threats that may adversely affect essential habitat or the survival of any of the populations.

This criterion has not been met. Coal mining activity continues to impair the Clinch and Powell rivers, especially in Virginia. In June 2008, a car accident resulted in a gas spill that affected a small portion of Citico Creek in the CNF. 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. Throneberry (2009) observed only one madtom (yellowfin) near constructed rock dams in 2007-8, and construction of the dams was noted as a potential threat to the yellowfin and smoky madtom. The construction of rock dams is also a threat to the yellowfin and smoky madtoms in Citico Creek within the CNF (Shute 2011, pers. comm.). 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. (See Section II.C.2 for additional discussion of threats.)

### **Smoky madtom**

Reclassification of the Smoky madtom (*Noturus baileyi*) to threatened status will be considered when:

1. Through protection of the existing Citico Creek population and by introductions of the species back into Abrams Creek, viable populations exist in both creeks (Blount and Monroe Counties, Tennessee).

The recovery plan defines a viable population here as 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 needed to meet this criterion will be determined as one of the recovery tasks.

Recovery Task 1.3.3. Determine the number of individuals required to maintain a viable population. This recovery task has not yet been completed. Genetic studies currently being conducted by Dr. Greg Moyer (Service) will provide baseline genetic and demographic data that may help determine this number (see section II.C.1.b).

In 1986, CFI began captive propagation of the smoky madtom for stocking into Abrams Creek, GRSM, 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 3,167 smoky madtoms were stocked into Abrams Creek (Shute et al. 2005). Monitoring conducted during the same time period revealed 123 observations of smoky madtoms (Shute et al. 2005). Stocking was discontinued in 2004 in order to monitor the populations and evaluate the status of the reintroduction effort in Abrams Creek. Since 2004, populations have been monitored annually. Average annual smoky madtom abundance indices (fish per person hour) have increased from 0 to 2.88 (Rakes and Shute 2007). In 2006, the smoky madtom abundance indices in Abrams Creek exceeded that in Citico Creek for the first time (Rakes and Shute 2007). CFI has consistently observed evidence of natural reproduction in Abrams Creek since 1996 (Shute et al. 2005). Smoky madtoms appear to be doing well in the Bell Branch area and the lower section of Abrams Creek [1.6 km (1 mi) or more before the confluence at Chilhowee Lake] (Shute 2008, pers. comm.).

Smoky madtoms have been established in Abrams Creek and have maintained themselves in the absence of additional stocking since 2004 (Rakes and Shute 2007). 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).

2. The U.S. Forest Service and National Park Service have implemented management plans for the species and have documented that management activities have eliminated threats to the species.

This criterion has not been fully met; however, both agencies have implemented management activities to further the recovery of the smoky madtom. In 2006, the NPS wrote the Service concerning critical research and management questions they proposed to address through local university research and interagency research proposals. The NPS attends and/or hosts annual meetings to discuss ongoing research and management needs.

Genetic monitoring of the yellowfin madtom, smoky madtom, and duskytail darter is currently underway to monitor levels of gene-flow/migration between Citico, Abrams, and Tellico creek populations for the Chilhowee Fishway Passage Strategy (CFPS). The strategy includes translocation of these three species between the three populations. The amount of migration between the populations and appropriate exchange rates (number of fish per generation per year) for the future will be determined.

In 2004, the CNF adopted a revision to their Land and Resource Management Plan (LRMP). A streamside filter zone was established to minimize the amount of sediment that enters CNF waterbodies. The filter zone is based on years of study at the Coweta Hydrological Research Center, and it specifies how close a ground disturbance may occur to perennial and intermittent streams, lakes and other water bodies. Therefore, the CNF LRMP goals and objectives contribute to the conservation and recovery of the yellowfin madtom and smoky madtom.

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. Visitors to the GRSM Abrams Creek Campground area and CNF campgrounds continue to build rock dams and channelize the river with large stones.

The Smoky madtom (*Noturus baileyi*) will be considered for delisting when:

1. Through protection of the existing Citico Creek population and by introductions of the species back into Abrams Creek, viable populations exist in both creeks.(See downlisting criteria discussion above)
2. The U.S. Forest Service and National Park Service have implemented management plans for these two populations and have documented that management activities are successfully protecting and managing the species. (See downlisting criteria discussion above)
3. Through introductions and/or discoveries of new populations, there exist viable populations in two other creeks within the species' historic range. (It is believed that at least two additional populations are required to ensure that the species will not become threatened in the foreseeable future).

This criterion has not been met. However, from 2002-2010, smoky madtoms were released into the Tellico River and progeny of the reintroduced fish have been observed in the river. From 2002 to 2010, a total of 2,125 smoky madtoms were reintroduced into the Tellico River and annual abundance indices for 2010 reached 2.2 fish per person-hour (Petty et al. 2011). A total of 65 smoky madtoms were observed in 2010; 45 of these individuals were progeny of the reintroduced fish (Petty et al. 2011).

4. All four populations and their habitat are protected from present and foreseeable human related and natural threats that may interfere with the survival of any of the populations.

This criterion has not been met. 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. Visitors to the GRSM Abrams Creek Campground area continue to build rock dams and channelize the river with large stones. Throneberry (2009) observed only one madtom (yellowfin) near constructed rock dams in 2007-8, and construction of the dams was noted as a potential threat to the yellowfin and smoky madtom. The construction of rock dams is also a threat to the yellowfin and smoky madtoms in Citico Creek within the CNF (Shute 2011, pers. comm.). In the upper Tellico River, OHV use in designated areas of the NNF threatened water quality and rare fish habitat. The FS closed all OHV trails to prevent water quality problems associated with OHV use. (See Section II.C.2 for additional discussion of threats.)

## C. Updated Information and Current Species Status

### 1. Biology and Habitat –

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

Yellowfin Madtom – Demographic information for the yellowfin madtom can be found in Dinkins and Shute (1996), along with additional life history information and distribution within Citico Creek in the CNF. Yellowfin madtoms were found in shallow pools with gravel, pebble, boulders, and bedrock (Dinkins and Shute 1996). Yellowfin madtoms were most frequently observed at night in open benthic areas, and adults were not observed in late fall. Dinkins and Shute (1996) speculated that adults and young may prefer different water temperatures, with young being more active at cooler temperatures than adults. Just after first leaf fall, juveniles and some adults can be found in shallow water over clean fine substrates with gentle stream flow (Rakes and Shute 2003). Shute (1984) suggested that dispersal may be primarily a function of juvenile migration in a downstream direction. Nesting occurs from May to July under large, flat rocks (Dinkins and Shute 1996) and is triggered by water temperatures between 20 and 23 °C (68 and 73.4 °F) (Shute 1984). The species lives three to four years and sexual maturity is reached in the third summer of life. The species shows evidence of polyandry (female mates with more than one male in a season) (Dinkins and Shute 1996).

In 1983, the yellowfin madtom was only known from relatively small reaches of Citico Creek, Powell River, and Copper Creek. The current range spans over 40 rkm (25 mi) in the Powell River, 6 km (3.7 mi) in Citico Creek, and 62 km (39 mi) of Copper Creek. The yellowfin madtom has been successfully reintroduced into at least 8 km (5 mi) of Abrams Creek, and is now being introduced into the Tellico River. In addition, the species has been rediscovered in the upper Clinch River and now occupies approximately 45 rkm (28 mi).

Davis et al. (2011) conducted a mark-recapture study of yellowfin madtom and smoky madtom stocked into Abrams Creek and found that the dispersal of released madtoms occurred within the first 20 hours after release. Capture efficiency was low and yellowfin madtom behavior following release made individuals susceptible to predation by large predatory fishes (Davis et al. 2011). Davis et al. (2011) recommends removing predators and blocking predators from the area with nets before stocking yellowfin madtom into an area to allow fish to acclimate to their new surroundings.

Smoky Madtom - Demographic information for the smoky madtom can be found in Dinkins and Shute (1996), along with additional life history information and

distribution within Citico Creek in the CNF. At that time, the smoky madtom was restricted to an approximately 10.8 km (6.7 mi) reach of Citico Creek (Dinkins and Shute 1996). The smoky madtom lives approximately two years and reaches sexual maturity in one year. Dinkins and Shute (1996) reported that nesting occurs from May to July under large flat rocks. However, CFI has observed spawning throughout August (Shute 2011, pers. comm.). The species shows evidence of polyandry (Dinkins and Shute 1996).

In 1985, the smoky madtom was only found in Citico Creek. The species has since been reintroduced into Abrams Creek and has maintained itself in the absence of stockings since 2004. The Citico Creek population is considered stable to increasing. The smoky madtom has also recently been introduced into the Tellico River, and there is now evidence of natural reproduction and successful recruitment of new year classes.

Davis et al. (2011) conducted a mark-recapture study of yellowfin madtom and smoky madtom stocked into Abrams Creek and found that the dispersal of released madtoms occurred within the first 20 hours after release. Capture efficiency was low and smoky madtom behavior following release made individuals susceptible to predation by large predatory fishes (Davis et al. 2011). Davis et al. (2011) recommends removing predators and blocking predators from the area with nets before stocking smoky madtom into an area to allow fish to acclimate to their new surroundings.

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

Yellowfin Madtom: Genetic analyses conducted on the Powell River, Citico Creek, and Copper Creek populations using molecular data indicate that these three populations are independent and that they should not be mixed during artificial propagation and release (Lang and Mayden, unpublished data). The relationship of the newly discovered Clinch River population is yet to be determined.

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

Smoky Madtom: See paragraph two above for yellowfin madtom.

**c. Taxonomic classification or changes in nomenclature:**

Yellowfin Madtom: There are no changes in the taxonomy of the yellowfin madtom since the Recovery Plan was written in 1983.

Smoky Madtom: There are no changes in the taxonomy of the smoky madtom since the Recovery Plan was written in 1985.

**d. Spatial distribution, trends in spatial distribution, or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):**

Yellowfin Madtom: The yellowfin madtom is currently restricted to approximately 40 km (25 mi) of the Powell River, 45 km (28 mi) of the Clinch River, 62 km (39 mi) of Copper Creek, 6 km (4 mi) of Citico Creek, 13 km (8 mi) of Abrams Creek, and approximately 5 km (3 mi) of the Tellico River (Rakes and Shute 2003, Throneberry 2009, Petty et al. 2011).

Smoky Madtom: The smoky madtom is currently restricted to approximately 14.5 km (9 mi) of Citico Creek, 9 km (6 mi) of Abrams Creek, and approximately 5 km (3 mi) of the Tellico River (Throneberry 2009, Petty et al. 2011).

**e. Habitat conditions:**

Yellowfin Madtom: Tennessee Technological University studies have characterized the macrohabitat (Throneberry 2009) and microhabitat (Miller 2011) of three rare fishes in Abrams Creek including the yellowfin madtom. Yellowfin madtom presence was negatively correlated with small boulder habitat in Abrams Creek, however, 44 percent of the observed individuals were found beneath small boulders (Throneberry 2009). Large boulders could not be effectively sampled, so yellowfin madtom use of these habitats was not accurately reflected. Yellowfin madtoms were also observed beneath bedrock overhangs and cracks (Throneberry 2009). Yellowfin madtoms preferred pool habitats beneath cobble and small boulder substrates (Miller 2011). The strongest habitat models identified preferred pools for yellowfin madtoms as greater than 40 meters (m) 131 feet (ft) in length with gravel being the main substrate beneath cover rocks (Miller 2011).

Smoky Madtom: Tennessee Technological University studies have characterized the macrohabitat (Throneberry 2009) and microhabitat (Miller 2011) of three rare fishes in Abrams Creek including the smoky madtom. Smoky madtom presence was negatively correlated with small boulder habitat in Abrams Creek (Throneberry 2009). The majority of smoky madtoms were found between Abrams Creek km 2.3 to 9 (mi 1.4 to 5.6), where sites had homogenous and connected suitable habitats (Throneberry 2009). Probability of smoky madtom presence increased with cobble substrate and decreased with other substrate types (Miller 2011). Smoky madtoms were observed in pools, runs, and riffles; however, they preferred riffle habitats (Miller 2011).

**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 their Recovery Plans (USFWS 1983, 1985), coal mining, logging, road and bridge construction and maintenance, toxic chemical spills, and siltation were identified as threats and remain threats today to the yellowfin madtom and smoky madtom. Additional, ongoing threats to the yellowfin madtom and smoky madtom include gravel dredging, water withdrawals, and agricultural practices.

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 River watershed. 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. In addition, Etnier and Jenkins (1980) suggested that madtoms, which are heavily dependent on chemoreception (detection of chemicals) for survival, might be susceptible to human-induced disturbances, such as chemical and sediment inputs, because the olfactory (sense of smell) “noise” they produce could interfere with a madtom’s ability to obtain food and otherwise monitor its environment. The effects of these types of threats will likely increase as human populations grow in the Tennessee River watershed 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 River watershed 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 yellowfin madtom and smoky madtom are negatively impacted.

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 yellowfin madtom by contributing sediment and contaminants into the watershed.

As indicated in the recovery plan, the yellowfin madtom is still affected by coal mining activities in the Powell River (USFWS 1983). Although coal fines can still be found in the river, the Powell River population is expanding. Coal mining activity has increased in the Clinch River watershed in recent years, 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 represent new threats, and may result in further impacts to the yellowfin and smoky madtom populations in Tennessee.

Agriculture continues to threaten the yellowfin madtom in the Clinch and Powell rivers and 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 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.

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 yellowfin madtom and smoky madtom are known to exist. The accident occurred approximately 3.2 km (2 mi) upstream from designated critical habitat for the smoky madtom, and no investigation to officially quantify take was conducted for listed fishes. 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. Throneberry (2009) observed only one madtom (yellowfin) near constructed rock dams in 2007-8, and construction of the dams was noted as a potential threat to the yellowfin and smoky madtom. The construction of rock dams is also a threat to the yellowfin and smoky madtoms in Citico Creek within the CNF (Shute 2011, pers. comm.). In the upper Tellico River, OHV use in designated areas of the NNF threatened water quality and rare fish habitat. The FS closed all OHV trails to prevent water quality problems associated with OHV use.

**b. Overutilization for commercial, recreational, scientific, or educational**

**purposes:**

Overutilization is not thought to be a factor in the decline of the yellowfin madtom or smoky madtom.

**c. Disease or predation:**

Disease is not thought to be a factor in the decline of the yellowfin madtom or smoky madtom. However, predation from larger catfish species could be a factor in the lack of success seen in recent Tellico River reintroductions.

**d. Inadequacy of existing regulatory mechanisms:**

In addition to the federal listings, the yellowfin madtom and smoky madtom are 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.

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 yellowfin madtom and smoky madtom 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 potential accidents involving vehicles transporting chemicals over road crossings of streams inhabited by the madtoms and accidental or intentional release into streams of chemicals used in agricultural or residential applications.

The yellowfin madtom and smoky madtom 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 -**

Yellowfin Madtom – The yellowfin madtom was historically collected from six streams in the Tennessee River basin including Chickamauga Creek, Hines Creek, North Fork Holston River, Copper Creek, Powell River, and Citico Creek. The yellowfin madtom is extirpated from Chickamauga Creek, Hines Creek, and the North Fork Holston River. However, the Copper Creek, Powell River, and Citico Creek populations are stable to increasing in size. CFI has augmented the Powell River and Copper Creek populations in Virginia. In addition, CFI has recently begun stocking yellowfin madtoms into the Tellico River and has plans to evaluate potential reintroduction sites in the North Fork Holston River in Virginia. CFI has successfully reintroduced this species into Abrams Creek in the GRSM. A population was discovered in the Clinch River after publication of the recovery plan, and recent surveys have consistently located additional individuals.

Although the distribution of the yellowfin madtom has greatly increased since the Recovery Plan was written in 1983; coal mining, agriculture, and recreational activities still make this species likely to become endangered throughout its range. Therefore, the status of the yellowfin madtom listed as threatened remains appropriate.

Prior to this review, the yellowfin madtom was given a recovery priority number of 11, reflecting a moderate degree of threat and low recovery potential. However, through the success of reintroduction efforts conducted by CFI, the species has shown a high recovery potential. Therefore, a change in recovery priority number from 11 to 8 is warranted.

Smoky Madtom – Historically, the smoky madtom was only collected in Citico and Abrams Creeks and it was only known from Citico Creek at the time of listing (49 FR 43065). However, CFI has successfully reintroduced the smoky madtom into Abrams Creek, where the species has shown evidence of natural reproduction since 1996. In addition, populations in Abrams Creek have remained stable in the absence of stocking

efforts since 2004. The Citico Creek population is increasing, and has recently become the source population for reintroductions into the Tellico River. Additionally, there is evidence of natural reproduction and successful recruitment of new year classes into the Tellico River. Due to its limited distribution and continuing threats, the smoky madtom continues to be in danger of extinction throughout its range. Therefore, the status of the smoky madtom listed as endangered remains appropriate.

Prior to this review, the smoky madtom was given a priority number of 5, reflecting the success of reintroduction efforts has increased the distribution of the smoky madtom and has shown that the species has a high recovery potential. However, the species' limited distribution continues to makes it extremely vulnerable to toxic spills and other stochastic events. The threat of a toxic spill and threats from ongoing recreational activities is believed to be moderate. Therefore, a change in recovery priority number from 5 to 8 is warranted.

### III. RESULTS

#### A. Recommended Classification:

  X   No change is needed

#### B. New Recovery Priority Number

Yellowfin Madtom:   8  

Smoky Madtom:     8    

The yellowfin and smoky madtom recovery priority numbers should be changed to an 8. The "8" indicates a moderate degree of threat and a high recovery potential.

### IV. RECOMMENDATIONS FOR FUTURE ACTIONS -

#### Yellowfin Madtom:

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, Throneberry 2009, Miller 2011).

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

Survey additional rivers, such as the North Fork Holston River, within the species' historic range to determine the availability and location of suitable introduction sites for future recovery efforts.

Conduct genetic analyses of all existing populations to determine the appropriate source population for future reintroduction/recovery efforts and to determine whether or not such efforts are warranted. If propagation is found to be warranted, incorporate these analyses into a propagation plan for the species.

Continue to utilize existing legislation and regulations (Federal and state endangered species laws, water quality requirements, stream alteration regulations, etc.) to protect the species and its habitat.

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

#### Smoky Madtom:

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

Continue genetic analyses comparing diversity within and among 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 and state endangered species laws, water quality requirements, stream alteration regulations, etc.) to protect the species and its habitat.

Continue efforts to reduce non-point pollution from agricultural activities by working through 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 Yellowfin Madtom (*Noturus flavipinnis*)**

Current Classification Threatened  
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 *Pepper W. Shute* Date 12/5/11  
for Mary E. JENNINGS

**REGIONAL OFFICE APPROVAL:**

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

Approve *Janet Mizzi* Date 1/27/12

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

Concur  Do Not Concur

Signature *[Signature]* Date 2/28/12

**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of Smoky Madtom (*Noturus baileyi*)**

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 *Peggy Photo* Date 12/5/11

*for Mary E. JENNINGS*

REGIONAL OFFICE APPROVAL:

*for* Lead Regional Director, Fish and Wildlife Service

Approve *Janet Wiji* Date 1/27/12

***APPENDIX A: Summary of peer review for the 5-year review of yellowfin madtom (*Noturus flavipinnis*) and smoky madtom (*Noturus baileyi*)***

- 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 detailed directions or forms to fill out for their review. They were asked for review of the science used in the document and not for review of the legal status determination.
- C. Summary of Peer Review Comments/Report – The CNF and TVA did not respond back with comments on the review. Conservation Fisheries, Inc., NPS, and VDGIF responded with minor edits to this document. Dr. Johansen responded back with information on the duskytail darter species complex. This information was used to revise the duskytail darter 5-year review, which is now a standalone document that will be finalized separately.
- D. Response to Peer Review – Peer reviewer edits were evaluated and incorporated into the revised document. In addition, the results of several research projects were incorporated into the document.