

# Re-introduction of the Smoky madtom, Little Tennessee River drainage, Tennessee

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## Introduction

The Smoky madtom (*Noturus baileyi*, Taylor, 1969) is endemic to the Little Tennessee River drainage in Tennessee. It was described from 5 original types collected during a reclamation (poisoning) project conducted on Abrams Creek in 1957 (Lennon and Parker 1959), which extirpated the smoky madtom population from Abrams Creek. The madtom was originally only known from Abrams Creek, Monroe Co., and because of the 1957 project was presumed extinct when it was formally described (Shute et al. 2005). It was subsequently listed as Endangered when an extant population was discovered in Citico Creek which is ~11 river km downstream from the mouth of Abrams Creek (Bauer et al 1983, Dinkins and Shute 1996, USFWS 1985). Presently one localized natural population occurs in a 14 km stretch of Citico Creek, Blount County. Re-introduction of captive bred smoky madtoms started in 1986 and these populations reintroduced to Abrams Creek and Tellico River are reproducing and dispersing. The species is listed as Critically Endangered (IUCN Red List) and Federally Endangered throughout its range in Tennessee, except in the Tellico River between the backwaters of the Tellico Reservoir and the Tellico Ranger Station where it's designated as a Nonessential Experimental Population (NEP).

## Goals

- Goal 1: Identification of potential re-introduction sites within the species' historic range.
- Goal 2: Captive propagation and restoration management at potential reintroduction sites.
- Goal 3: Sustainable populations of smoky madtoms established in all areas where there is suitable habitat and hydrology.
- Goal 4: Annual monitoring of all smoky madtom populations (both natural and re-introduced).

## Success Indicators

- Indicator 1: Self-sustaining populations established at reintroduction sites.
- Indicator 2: Overall geographical distribution of the species extended.

## Project Summary

Captive propagation of the federally endangered (USFWS 1984) Smoky madtom has been part of a joint effort that was initiated in 1986 to reintroduce the species (along with three other listed fish species) into Abrams Creek, Great Smoky Mountains National Park, Blount County (Shute et al. 2005) as recommended in the Recovery Plan for the species (USFWS 1985). Conservation Fisheries, Inc. (CFI) of Knoxville, Tennessee, has managed the captive propagation and is the lead in monitoring both source and target populations. These efforts have been funded by the Tennessee Wildlife

Resources Agency (TWRA), U.S. Fish and Wildlife Service (USFWS), and Cherokee National Forest (CNF). Additional cooperators in this reintroduction project include the North Carolina Wildlife Resources Commission, National Park Service, Great Smoky Mountains National Park, and the U.S. Forest Service. CFI's responsibilities in this effort include project coordination, captive rearing of wild-collected nests, captive breeding and rearing efforts, stockings, and annual population monitoring of all four species in Abrams Creek and the source populations in Citico Creek. Eggs and young to rear for the effort have been collected annually from nearby Citico Creek, now isolated from Abrams Creek by Chilhowee and Tellico reservoirs. Over the 20-year span, more than 3400 Smoky madtoms have been released. The species is reproducing, recruiting, and dispersing into suitable habitats in Abrams Creek, where numbers of fishes now often rival those seen in the source population in nearby Citico Creek (Shute et al. 2005, Rakes 2011). In the absence of reintroductions since 2002 the Smoky madtom population is maintaining itself in Abrams Creek.

Beginning in 2003, the pilot project was extended to a new restoration stream, the Tellico River, following publication of the final rule designating Nonessential Experimental Population (NEP) status under the ESA (USFWS 2001, 2002) for all four species in a reach of the river found to have suitable habitat (Rakes and Shute 1998). Reintroductions of the species into its historical habitat in the Tellico River upstream from Tellico Reservoir, Monroe County, are currently ongoing. Over 2100 fish have been stocked and wild reproduction has been observed every year since 2004 (Petty et al. 2011, Rakes 2011).

Methods for propagation, restoration, and monitoring are described in Shute et al. (2005) and rely upon collection and rearing of wild nests of madtom eggs and/or larvae in the CFI hatchery facility. Attempts to induce captive breeding have been largely unsuccessful and determined nonessential to the success of this effort. Smoky madtoms have a maximum lifespan of only two years and produce as little as 30 eggs per female per year (Dinkins and Shute 1996), making long term maintenance of broodstock populations difficult at best. The successful restoration of this rare species to Abrams Creek and, apparently increasingly likely, Tellico River (Petty et al. 2011), could potentially result in downlisting to threatened status per Recovery Plan criteria.

Meetings of all project partners have occurred annually to evaluate progress and decide upon future goals. At the onset of the reintroduction project an extensive health screening program of captive fish was established. At ~one month prior to releases, fish undergo parasitological and bacterial screening. Prior to any transfer of fish from CFI to any other facility, or any reintroductions, a sample of the appropriate captive population, representing each system occupied, if applicable, was sent to the Warm Springs National Fish Hatchery to screen for any detectable disease pathogens. Disease detection would initiate actions necessary to prevent the transfer of any pathogens between facilities or to wild populations of fish. All young-of-year captive madtoms were tagged prior to release using the Visible Implant Fluorescent Elastomer (VIE) tags produced by Northwest Marine Technologies. Prior to marking, fishes were

anesthetized using MS-222 at a rate of approximately 100 mg/l. Injections of the elastomer material were made using ultra-fine, 1/2cc, 29 gauge insulin syringes.

Through the Tallassee Fund, Alcoa Power Generating Inc. (Tapoco Division) has funded a genetics study and fish population/ habitat studies. The goal of these studies includes monitoring levels of gene-flow/migration between the Citico, Abrams, and Tellico Creek populations of four federally threatened fish species--Spotfin chub, Smoky madtom, Yellowfin madtom, and Citico darter--as outlined. Preliminary analyses have been completed, and additional tissue samples were collected in 2010-2011. The genetics report will provide an objective/quantitative evaluation for a fish passage strategy. More important, these projects provide needed baseline genetics, demographic, population, and habitat data for these target imperiled species, which may prove vital to their long-term survival and management. Although additional monitoring will be required to document that these reintroduced populations are viable, captive propagation and reintroductions have proven to be a successful means for reestablishment of extirpated populations of these fish.

### Major difficulties faced

- Since it is known only from a 14 km portion of Citico Creek (with no population estimates), an accidental chemical spill or increased acidity due to run-off from sulfate rich Anakeesta shales in the watershed could quickly eliminate the only known naturally occurring population (Etnier and Starnes 1993).
- Threatened by logging activities, road and bridge construction, and mineral exploration; water quality may be further degraded as acidic waters leach toxic metals (especially aluminum) from the soil.
- Recently the USFS proposed a 4-acre parking area adjacent to Citico Creek in the vicinity of Citico Creek Road and Buck Highway (Creek Mile 9.0) and the construction of 17.2 miles of new equestrian trails in the Cherokee National Forest. This is perhaps one of the most sensitive areas within the Citico watershed being the center of the population of the federally-threatened Yellowfin madtom, *N. flavipinnis* within the stream. The Smoky madtom is also common in that immediate area.
- Until recently, the National Park Service sought to maintain the historical integrity of the park by allowing cattle farming in Abrams Creek headwaters resulting in sediment loading and elevated nutrient concentrations. Since 1993, a cooperative project between NPS, USFS, University of TN, TVA, Trout Unlimited, and a local wildlife artist improved water and habitat quality by restoring riparian vegetation and fencing and removing cattle.
- Part of the stocking area in Abrams Creek is adjacent to a well-used NPS campground and includes many frequent park users and visitors, locally and from across the country. Educational information was necessary to lessen the impacts of unintentional habitat destruction or fish harassment by these visitors. Campers building small rock dams in the creek reduce the spawning cover available for nesting madtoms and could also be reducing reproductive success by dislodging eggs.

### Major lessons learned

- A partnership of co-operative stakeholders that meet regularly enabled decisions to be made quickly and appropriate actions implemented.
- Management decisions must be informed by scientific research.
- Must continue to work with public and private stakeholders on sustaining and improving the watershed management plan designed to encourage BMPs in construction, forestry, water development, and agriculture. This includes signs and education efforts to reduce dam-building which destroys cover and nesting habitat.
- The program has been running for nearly 25 years, and during this time has tried to embrace new ideas and protocols in reintroduction practice as they have been developed. Consequently the whole program has 'evolved' rather than been 'planned'. Our experiences prompt us to caution others looking for success in similar projects not to abandon efforts prematurely. It takes time to document success when stocking limited numbers of benthic non-game fishes because they are small, short-lived, and cryptic. Thus, they probably do not quickly move far from stocking sites.

### Success of project

Highly Successful	Successful	Partially successful	Failure
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### Reasons for success:

- Smoky madtom populations still appear to be well established in lower reaches of Abrams Creek in the absence of any reintroductions in more than eight years.
- Both of the re-introductions appear to have been successful. This has resulted in a doubling of the original geographical range of the species.
- Abundance indices for the species reintroduced to Tellico River were higher in 2010 than the previous year and we again documented that the species successfully reproduced for the fourth consecutive year. The annual abundance index for Smoky madtoms for Tellico was nearly equivalent to that for Citico (2.2 vs. 2.3) with a record number of 65 Smoky madtoms observed. This endangered species is becoming so well established that reintroductions in core restoration areas in Tellico are probably no longer necessary and stocking of peripheral localities to accelerate dispersal and expand distribution in the Tellico River should now be a goal.
- The restoration of this species is nearing the point where stocking can be terminated and monitoring and genetic sampling can become the primary recovery activities.

### References

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