

Re-introduction of the Citico darter, Little Tennessee River drainage, Tennessee

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Introduction

The Citico darter (*Etheostoma sitikuense*, Blanton) is endemic to the Little Tennessee River drainage in Tennessee. The species is listed as Critically Imperiled (IUCN) and federally endangered throughout its range. Until recently this darter was part of the duskytail darter, *E. percnurum* Jenkins, complex. The Citico darter was accepted as a new species when Blanton and Jenkins (2008) described 3 new species of darter belonging to this complex. The species occupies an approximately 3.5 river km reach of Citico Creek in Monroe County; a tributary of Tellico Lake, an impoundment of the mainstem Little Tennessee River. The darter is historically extirpated from Abrams Creek, a tributary of Chilhowie Lake also impounding the Little Tennessee River, in Great Smoky Mountains National Park, where it is known from three specimens collected in 1937 and 1940. This and three other listed fish species were extirpated from Abrams Creek by application of rotenone during 1957, a plan designed to reduce food and habitat competition for a Rainbow trout fishery (Lennon & Parker 1959). Citico darter has been propagated and reintroduced to lower Abrams Creek, below Abrams Falls and stocked in Tellico River using Citico Creek stocks (Shute et al. 2005; Petty et al. 2011).

Goals

- Goal 1: Identification of re-introduction sites within the species' historic range.
- Goal 2: Captive propagation and restoration management at reintroduction sites.
- Goal 3: Sustainable populations of Citico darter established in all areas where there is suitable habitat and hydrology.
- Goal 4: Annual monitoring of all Citico darter 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 Citico darter 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, Tennessee (Shute et al. 2005) as recommended in the Recovery Plan. Conservation Fisheries, Inc. (CFI) of Knoxville, Tennessee, has managed the captive propagation. These efforts have been funded by the Tennessee Wildlife Resources Agency, U.S. Fish and Wildlife Service, and Cherokee National Forest. 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, 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. Work with this species began in 1992, with the first stockings in 1993. 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 Citico darter 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. Over 3500 Citico darters have been stocked, wild reproduction has been observed nearly continuously since 2004, and multiple age classes of wild-spawned individuals are routinely observed (Petty et al. 2011). It will take several more years of reintroductions to ensure future success similar to the Abrams Creek reintroductions.

Methods for propagation, restoration, and monitoring are described in Shute et al. (2005) and rely upon collection and rearing of wild nests of Citico darter eggs and/or larvae in the CFI hatchery facility. All monitoring and collections of fish and nests are performed by snorkeling. Fish are captured with hand nets and transported inside plastic bags in a cooler. Nests (i.e., eggs attached to the bottoms of slab rocks) are carefully placed in coolers of river water, on a plastic grid to prevent crushing of hatching larvae in transit. At the CFI facility they are slowly acclimated into a multi-aquarium recirculating system. A portion of the adults kept as breeders are winter-conditioned from November through February by reduction of water temperatures and photoperiod shortened to 9 hours of light. Reproductive condition is induced by gradually increasing water temperatures, photoperiod, and food quantity offered, in concert with natural seasonal changes. An astronomic timer controls artificial lighting inside the facility with automated daily adjustments to closely mimic seasonally changing daylength. Attempts to induce captive breeding have been infrequent and determined nonessential to the success of this effort. The successful restoration of this rare species to Abrams Creek and, increasingly likely, Tellico River (Petty et al. 2011), could potentially result in downlisting 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. Approximately 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.

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

- 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 darters and could also be reducing reproductive success by dislodging eggs.
- Recently the USFS proposed a 4-acre parking area adjacent to Citico Creek 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 Yellowfin madtom and Citico darter populations within the stream.

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 nearly 10 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:

- Citico darter populations still appear to be well established in 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 Tellico River were higher in 2010 than the previous year and we again documented that the species successfully reproduced for the fourth consecutive year.

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