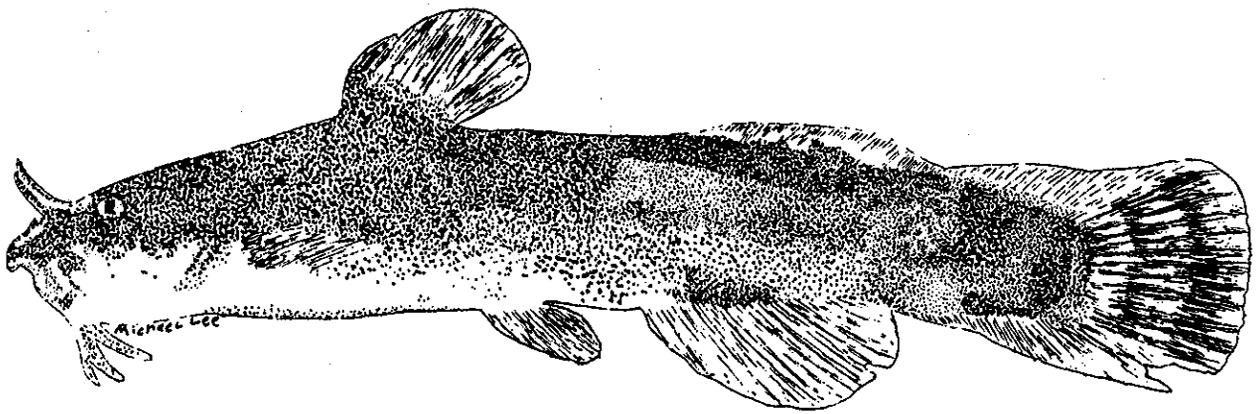


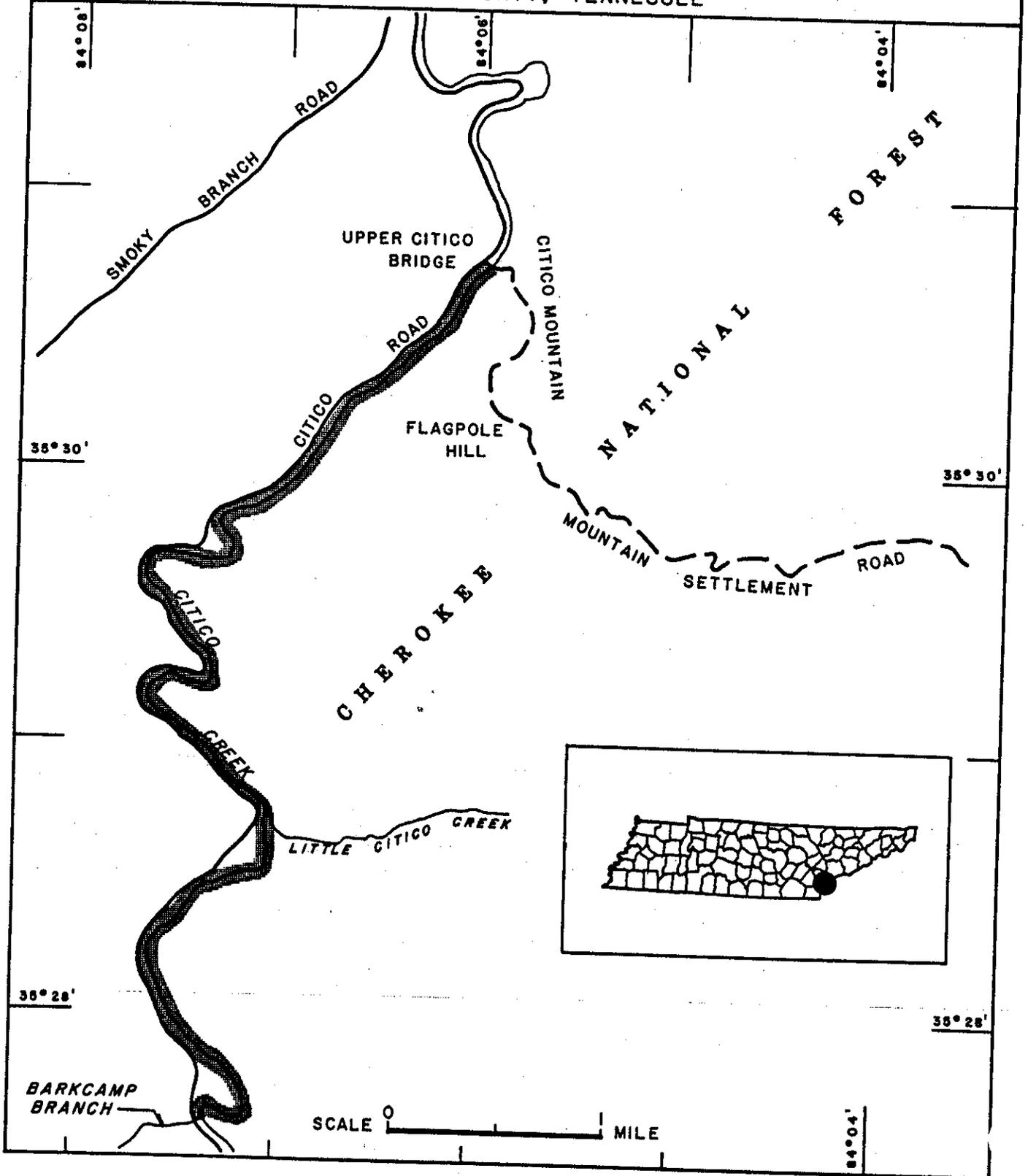
SMOKY MADTOM



RECOVERY PLAN

SMOKY MADTOM
CRITICAL HABITAT

MONROE COUNTY, TENNESSEE



RECOVERY PLAN
for
Smoky Madtom (Noturus baileyi) Taylor

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Date: August 9, 1985

THIS IS THE COMPLETED SMOKY MADTOM RECOVERY PLAN. IT HAS BEEN APPROVED BY THE U.S. FISH AND WILDLIFE SERVICE. IT DOES NOT NECESSARILY REPRESENT OFFICIAL POSITIONS OR APPROVALS OF COOPERATING AGENCIES, AND IT DOES NOT NECESSARILY REPRESENT THE VIEWS OF ALL INDIVIDUALS WHO PLAYED A ROLE IN PREPARING THIS PLAN. THIS PLAN IS SUBJECT TO MODIFICATION AS DICTATED BY NEW FINDINGS, CHANGES IN SPECIES STATUS, AND COMPLETION OF TASKS DESCRIBED IN THE PLAN. GOALS AND OBJECTIVES WILL BE ATTAINED AND FUNDS EXPENDED CONTINGENT UPON APPROPRIATIONS, PRIORITIES, AND OTHER CONSTRAINTS.

ACKNOWLEDGEMENTS SHOULD READ AS FOLLOWS:

U.S. Fish and Wildlife Service. 1985. Smoky Madtom Recovery Plan.
U.S. Fish and Wildlife Service, Atlanta, Georgia. 28 pp.

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PART I

INTRODUCTION

The smoky madtom (Noturus baileyi), a small member of the catfish family, was believed to have become extinct in 1957 when it was extirpated from Abrams Creek, Great Smoky Mountains National Park, Blount County, Tennessee. It was rediscovered in Citico Creek in 1980 (Bauer et al., 1983), and the results of an extensive survey (Dinkins, 1982) indicate that the species is now apparently restricted to approximately 6.5 miles (10.5 km) of Citico Creek primarily within the Cherokee National Forest, Monroe County, Tennessee. With this restricted range, a single catastrophic event could render the species extinct.

The species was originally discovered in 1957 in Abrams Creek, a Little Tennessee River tributary in the Great Smoky Mountains National Park, Blount County, Tennessee, by a Fish and Wildlife Service crew which was treating the creek with a fish toxicant to remove unwanted fish species from the Chilhowee Reservoir Watershed prior to the closure of Chilhowee Dam. This was a routine procedure at the time, designed to enhance the chances of establishing a trout fishery in the new reservoir. The smoky madtom specimens taken (five individuals) from Abrams Creek during this project were used by Taylor (1969) to describe the species.

The smoky madtom was listed as an endangered species on October 26, 1984, Federal Register (49 FR 43065). Concurrently with that listing, critical habitat was designated to include the following:

Citico Creek - Cherokee National Forest, Monroe County, Tennessee, from the Cherokee National Forest boundary at upper Citico Creek Bridge on Mountain Settlement Road [approximately creek mile 4.3 (6.9 km)] upstream to the confluence of Citico Creek with Barkcamp Branch [approximately creek mile 10.8 (17.4 km)]. [Note: Critical habitat does not coincide with the species' known distribution. The upstream extent of critical habitat is 0.6 miles above the known range of the species. This extension was needed in order to provide a definable landmark (Barkcamp Branch) for critical habitat. One smoky madtom was found downstream of the U.S. Forest Service boundary, but this stream section contained little of the fishes' preferred habitat. Therefore, this section was not designated as habitat critical to the species' survival.]

Former and Present Distribution

The former range of the smoky madtom is impossible to determine because of the lack of preimpoundment fish surveys. However, Etnier et al. (1984) stated that the species may have occurred in the main channel of the Little Tennessee River upstream to the Tennessee--North Carolina border prior to the construction of impoundments. Dinkins (1982) surveyed specifically for the smoky madtom at 44 locations in the Little

Tennessee River drainage in North Carolina and Tennessee; two tributaries of the Hiwassee River system, Tennessee; and one tributary of the Pigeon River, Tennessee. Although some habitat looked favorable for the species, no smoky madtoms were found outside Citico Creek.

The fish has been collected from only two tributaries of the Little Tennessee River--Abrams Creek, Great Smoky Mountains National Park, Blount County, Tennessee; and Citico Creek, Cherokee National Forest, Monroe County, Tennessee. According to Dinkins (1982), the now extirpated population in Abrams Creek probably ranged from the National Park Service Campground downstream. The downstream extent of this now extinct population is unknown. The Citico Creek population presently exists in 6.5 miles (10.5 km) of Citico Creek from approximately creek mile 3.7 (5.9 km) upstream to creek mile 10.2 (16.4 km).

Description, Ecology, and Life History

The smoky madtom (see photo) is a small [largest 61.5 mm (2.5 inches) SL, 73.0 mm (2.9 inches) TL] light brown colored catfish (see Taylor, 1969). Its head is relatively large and rounded above, the eyes are small, and the mouth is subterminal with very short barbels. The pectoral spines are only slightly curved and have fine anterior serral and moderately large posterior serral. The dorsal spine is short, about 2/5 length of longest dorsal ray. The dorsal area is marked with four small saddles located, on top of the head, beneath the front of the dorsal fin, between

the dorsal fin and the adipose fin, and beneath the adipose fin. Very little is known about the species' biology, although, Dinkins (1982) and Etnier et al. (1984) reported on some of its life history requirements.

Food Habits: Examination of 13 smoky madtom stomachs revealed that aquatic insect larvae predominated in their diet. Five of the fish had consumed gravel, which Etnier et al. (1984) suggested may indicate the fish feeds by picking prey items from the substrate.

Habitat Preference: Citico Creek, in the section inhabited by the smoky madtom (creek mile 3.7 to 10.2--creek km 5.9 to 16.4), has a gradient of 13.2 feet/mile (2.5 m/km), while the creek section above the inhabited area (apparently unsuitable for the fish) has a gradient of 76.6 feet/mile (14.5 m/km) (Etnier et al., 1984). The inhabited creek section is characterized by shallow riffles [less than 19.7 inches (50 cm) deep] containing abundant flat, palm size slab rocks, shallow pools [19.7-39.4 inches (50-100 cm) deep] with pea size gravel and scattered flat rocks, and deep pools [3.3-6.6 feet (1-2 m) deep] with silty/sandy bottoms and large boulders.

The species, from late May through early November, was found in close association with riffle areas (Dinkins, 1982). Here they occurred in all parts of the riffle, especially at the crests under palm size slab rocks. Dinkins (1982) reported that when disturbed from slab rocks they sought

shelter by burying themselves headfirst into the gravel substrate. From late November through early May, the fish utilized shallow pool areas (Etnier et al., 1984) and were again found under slab rocks.

Reproduction: Dinkins (1982) reported that female smoky madtoms in breeding condition were collected from May 13 to July 7. Males in breeding condition were found from July 2 to August 19, but Dinkins believes that males probably began to ripen earlier. A total of five smoky madtom nests were located by Dinkins (1982). The nests were observed between July 7 and July 14, and three of the nests were disturbed to collect scientific data.

The three examined nests had 35, 40, and 42 eggs, respectively. They were found under large rocks and were located in areas with moderate current in water depths 15.7 inches (40 cm) to 25.6 inches (65 cm). The eggs were in a shallow depression under the rocks and adhered to each other in a mass. All three nests were attended by guarding madtoms. One of these guardian fish was preserved and it was a male (1.73 inches--44 mm SL, 2.0 inches--52 mm TL). The two nests (left undisturbed) were observed on July 14 and both contained newly hatched fry.

Reasons for Decline and Threats to Its Continued Existence

The species was known from Abrams Creek, Blount County, Tennessee, but was apparently extirpated when the creek was treated with a fish

toxicant. The smoky madtom may have existed in the Little Tennessee River, but impoundments have greatly altered that habitat.

The fish is now known from only 6.5 miles (10.5 km) of Citico Creek, Monroe County, Tennessee. With such a limited distribution, the fish could be rendered extinct by a single catastrophic event either natural or human related. Potential threats to the species and its critical habitat could also come from logging activities, road and bridge construction and maintenance, mineral exploration and mining, and other projects in the watershed if these activities are not planned and implemented with the survival of the species in mind.

Other than potential soil erosion and siltation problems associated with any land disturbance, a more serious problem could arise in this watershed. The Citico Creek watershed contains geologic formations of anakeesta shale, an acid bearing rock, which has caused problems in the past. Bergendahl et al. (1977) reported that in the 1970s, a formation of anakeesta was exposed during construction of the Tellico/Robbinsville Highway. Acid leaching from a road cut increased the concentration of sulfates, heavy metals, and acidity in Grassy Branch, a tributary of the South Fork Citico Creek. Surveys of Grassy Branch in 1978 revealed no fish life. Attempts have been made to mitigate this problem, but they have not been entirely successful. Other formations of anakeesta occur in the Citico Creek watershed, and there is

a danger that they could be exposed during road construction and/or mining activities.

Several species of madtom, for still unexplained reasons, have been extirpated from portions of their range. Etnier and Jenkins (1981) speculated that this may ". . .in addition to visible habitat degradation, be related to their being unable to cope with olfactory 'noise' being added to riverine ecosystems in the form of a wide variety of complex organic chemicals that may occur only in trace amounts." High levels of an organic chemical, ptholate ester, have been found in Caney Creek, a tributary of Citico Creek which enters the critical habitat area. If madtoms are adversely impacted by increased concentrations of complex organic chemicals such as ptholate ester, this chemical could cause a problem for this isolated population.

The increased use of Citico Creek for recreation could pose a threat to the species. Etnier et al. (1984) reported that some people using the area for recreation build small dams using stream rocks. These rocks are also used by smoky madtoms during June and July for nesting. Dinkins (1982) reported that disturbance of nest rocks had caused nests to be abandoned by the guardian madtom and resulted in loss of eggs to predation. Egg masses can also be dislodged from under the rocks and float away if the nest rock is even slightly disturbed (Etnier et al., 1984).

The U.S. Forest Service manages Indian Boundary Lake on North Fork Citico Creek for sport fishing. This lake is sometimes drained and ichthyocides used to control nongame fish species. The Forest Service is aware of the potential impacts to the smoky madtom and will need to take the necessary precautions to protect the species and its critical habitat.

PART II
RECOVERY

A. RECOVERY OBJECTIVES:

The ultimate goal of this recovery plan is to establish four viable populations* of the smoky madtom (Noturus baileyi), and protect the species and its habitat to such a degree that the species no longer qualifies for protection under the Endangered Species Act.

(*Viable populations: 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 to meet this criterion will be determined as one of the recovery tasks.)

The first step in the recovery process would be to recover the species to the point that it could be reclassified from endangered to threatened.

This would be possible if the following criteria are met.

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.
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.

The final step in the recovery process would be to remove the smoky madtom from the Act's protection. However, it is unlikely that this can be accomplished. The species presently exists in a short stretch (6.5 miles) of one stream and its historic range includes only one other stream. Therefore, even if viable populations are established in each of these streams, it is unlikely threats can be eliminated in these watersheds to the point that the species could be removed from Endangered Species Act protection. However, if additional populations can be found, or if additional historic habitat can be delineated and reestablished with viable populations, the species could be considered for delisting. The smoky madtom shall be considered recovered when the following criteria are met.

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.
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.

3. Through introductions and/or discoveries of new populations, there exists 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.)
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.

B. STEP-DOWN OUTLINE

1. Preserve Citico Creek population and presently used habitat of the smoky madtom.
 - 1.1 Continue to utilize existing legislation and regulations (Federal Endangered Species Act, State Endangered Species Laws, water quality requirements, stream alteration regulations, etc.) to protect the smoky madtom and its habitat.
 - 1.2 Assist the U.S. Forest Service in development of an interim research and management plan for the Citico Creek population.

- 1.3 Conduct research necessary for the management and recovery of the Citico Creek population.
 - 1.3.1 Conduct life history research on the species to include reproduction, food habits, age and growth, mortality factors, etc.
 - 1.3.2 Characterize the species' habitat (relevant physical, chemical, and biological components) for all life history stages.
 - 1.3.3 Determine the number of individuals required to maintain a viable population.
 - 1.3.4 Determine present (including monitoring of pH to determine possible impacts of acid-bearing rocks) and foreseeable threats to the species and implement protective measures.
 - 1.3.5 Investigate the need and value of habitat improvement. Implement improvements if needed to secure viable populations.
 - 1.3.6 Investigate the need and value of developing an information education program geared at protecting

the quality of Citico Creek. Implement education effort if needed to secure a viable population.

2. Search for additional populations.
3. Determine the feasibility of reestablishing the smoky madtom back into its historic habitat in Abrams Creek, Great Smoky Mountains National Park, and to other suitable stream reaches that are determined to have been historic habitat.
 - 3.1 Develop a successful technique for reestablishing populations.
 - 3.2 Reintroduce the smoky madtom back into its historic range.
4. Assist the lead land management agency for each population in developing and implementing a program to manage the smoky madtom and monitor population levels and habitat conditions of the presently established population as well as introduced populations.
5. Annually assess overall success of the recovery program and recommend action (changes in recovery objectives, delist, continue to protect, implement new measures, other studies, etc.).

C. NARRATIVE OUTLINE

1. Preserve Citico Creek population and presently used habitat of the smoky madtom. As the Citico Creek population is the only one known to exist, it is essential that this population be protected.
 - 1.1 Continue to utilize existing legislation and regulations (Federal Endangered Species Act, State Endangered Species Laws, water quality requirements, stream alteration regulations, etc.) to protect the smoky madtom and its habitat. Prior to and during implementation of this recovery plan, the species and its habitat can be protected by the full enforcement of existing laws and regulations.
 - 1.2 Assist the U.S. Forest Service in development of an interim research and management plan for the Citico Creek population. The smoky madtom habitat in Citico Creek is primarily under the jurisdiction of the U.S. Forest Service. Their present management of the watershed provides the species with a quality habitat. However, there may be certain management practices that could be altered to provide greater benefit to and protection for the species and its habitat. The interim plan would provide guidance

until further research can aid in the refinement of management techniques.

1.3 Conduct research necessary for the management and recovery of the Citico Creek population.

1.3.1 Conduct life history research on the species to include reproduction, food habits, age and growth, mortality factors, etc. The work of Dinkins (1982) and Etnier et al. (1984) indicates that much needs to be learned concerning the species' life history. Unless the species' life cycle and environmental requirements are defined, recovery efforts may be inconsequential or misdirected. As the Citico Creek population of the smoky madtom is very vulnerable, extreme care must be taken to ensure that research does not further threaten the species.

1.3.2 Characterize the species' habitat (relevant physical, chemical, and biological components) for all life history stages. Knowledge of the species' habitat needs will enable recovery efforts to focus management and protection activities on the habitat and ecological associations required for the survival of the species.

1.3.3 Determine the number of individuals required to maintain a viable population. Theoretical considerations by Franklin (1980) and Soulé (1980) indicate that 500 individuals represent a minimum population level (effective population size) which would contain sufficient genetic variation to enable that population to evolve and respond to natural habitat changes. The actual population size in a natural ecosystem can be expected to be larger, possibly by as much as ten times. The factors which will influence actual population size include sex ratio, length of species' reproductive life, fecundity, extent of exchange of genetic material within the population, plus other life history aspects of the species. Some of these factors can be addressed under Task 1.3.1, while others will need to be addressed as part of this task on a need-to-know basis.

1.3.4 Determine present (including monitoring of pH to determine possible impacts of acid-bearing rocks) and foreseeable threats to the species and implement protective measures. The species and its habitat appear in good condition but the following threats do exist: (a) The species occurs in only 6.5 creek

miles and is thus vulnerable to a single catastrophic event. (b) An organic chemical and nutrient enrichment have been found to occur in Caney Creek, a tributary of Citico Creek. (c) The Citico Creek watershed contains acid-bearing rock which has caused fish kills in the past. (d) The use of stream rocks to build small rock dams, by people using the creek for recreation, is believed to disturb spawning madtoms. (e) Other recreational uses of the creek may also be impacting the species.

- 1.3.5 Investigate the need and value of habitat improvement. Implement improvements if needed to secure viable populations. Etnier et al (1984) reported that ". . .the main factor suspected of limiting the abundance of N. baileyi in Citico Creek is the availability of slab rocks." Results of Task 1.3.1 and 1.3.2 may show that increasing the number of slab rocks at sites where they are deficient and/or other habitat adjustments may be beneficial to the species.
- 1.3.6 Investigate the need and value of developing an information education program geared at protecting the quality of Citico Creek. Implement education

effort if needed to secure a viable population. As the fish is restricted to such a short river reach, information dissemination must be balanced with the potential for increasing the threat to the species resulting from notoriety.

2. Search for additional populations. A study of the smoky madtom, funded by the Service, was completed in November 1982, (Dinkins, 1982). That survey involved extensive sampling at 44 locations in the Little Tennessee River Drainage in North Carolina and Tennessee; two tributaries in the Hiwassee River, Tennessee; and one tributary in the Pigeon River, Tennessee. Although some habitat looked favorable for the species, the smoky madtom was not found outside Citico Creek.

Although it is unlikely that other populations will be found, further survey may be warranted after the studies under Task 1.3.1 and 1.3.2 better define the species' habitat requirements. This information should aid in delineating specific habitat types that could be more thoroughly searched.

3. Determine the feasibility of reestablishing the smoky madtom back into its historic habitat in Abrams Creek, Great Smoky Mountains National Park, and to other suitable stream reaches that are determined to have been historic habitat. The smoky

madtom was extirpated from Abrams Creek (the only known historic habitat other than Citico Creek) in the 1950s. Habitat for the species is apparently still available, and the National Park Service has expressed an interest in reintroducing the species. Although none are presently known, other historic habitats may still be available for introductions.

3.1 Develop a successful technique for reestablishing populations.

Because of the short stream reach involved, sufficient numbers of smoky madtoms likely are not available in Citico Creek to allow for the removal of adults to establish new populations. Techniques for propagating madtom fry for stocking as well as other introduction techniques must be developed before the smoky madtom can be reintroduced into other waters.

3.2 Reintroduce the smoky madtom back into its historic range.

Using techniques developed in Task 3.1, reintroduce the species into Abrams Creek and, if available, other historic habitat.

Monitor all new populations.

4. Assist the lead land management agency for each population in developing and implementing a program to manage the smoky madtom and monitor population levels and habitat conditions of the presently established populations as well as introduced

populations. Once recovery actions are implemented, the species must be managed, and the response of the species and its habitat must be monitored to assess any progress towards recovery.

5. Annually assess overall success of the recovery program and recommend action (changes in recovery objectives, delist, continue to protect, implement new measures, other studies, etc.). The recovery plan must be evaluated periodically to determine if it is on track and to recommend future actions. As more is learned about the species, the recovery objectives may need to be modified.



Smoky madtom (*Noturus baileyi*)
Photo by J. R. Shute

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KEY TO IMPLEMENTATION SCHEDULE COLUMNS 1 & 4

General Category (Column 1):

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - 0

1. Information and education
2. Law enforcement.
3. Regulations
4. Administration

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Priorities within this section (Column 4) have been assigned according to the following:

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

Smoky Madtom

Part III Implementation Schedule

*1 General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency *2		Estimated Fiscal Year Costs			*3 Comments/Notes	
					FWS Region	Program	Other	FY 1	FY 2		FY 3
01-04	Continue to utilize existing legislation and regulations to protect species and habitat.	1.1	1	Continuous	4	SE&ES	Tennessee Valley Authority (TVA), Tennessee Wildlife Resources Agency (TWRA), Tennessee Heritage Program (THP), and U.S. Forest Service (USFS)	1,000	1,000	1,000	*1. See preceding page: general categories for Implementation Schedules. *2. Other agencies' responsibility would be of a cooperative nature or projects funded under a contract or grant program. In some cases contracts could be let to universities or private enterprises. *3. Note: <u>ALL ESTIMATES ARE FOR FWS FUNDS ONLY.</u>
11-14, M1-7	Assist USFS in developing an interim research and management plan for Citico Creek population	1.2	1	1 yr.	4	SE	USFS, TWRA, THP, and TVA	---	---	---	
13-11	Conduct research into life history, habitat requirements, and numbers of individuals needed to maintain a viable population.	1.3.1 1.3.2 and 1.3.3	1	3 yrs.	4	SE	USFS, TWRA, THP, and TVA	20,000	15,000	15,000	
11,2 & 12	Determine present and foreseeable threats.	1.3.4	1	2 yrs.	4	SE	USFS, TWRA, THP, and TVA	---	5,000	5,000	
14	Investigate the need for habitat improvement.	1.3.5	2	1 yr.	4	SE	USFS, TWRA, THP, and TVA	---	---	2,000	Cost figure is only to investigate the need for improvements.
01	Investigate need of I & E program.	1.3.6	2	1 yr.	4	SE	USFS, TWRA, THP, and TVA	---	---	1,000	Cost figure is only to investigate need. It does not cover development.
11	Search for additional populations.	2.0	3	1 yr.	4	SE	USFS, TWRA, THP, and TVA	---	---	10,000	

Part III Implementation Schedule

Smoky Madtom

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS Region	Program	Other	FY 1	FY 2	FY 3	
17,14	Develop a successful technique for establishing new populations.	3.1	1	2 yrs.	4	SE	USFS, THP, TMRA, THP, TVA and NPS (National Park Service)	10,000	10,000	---	
M1,2	Reintroduce smoky madtom back into its historic range.	3.2	1	1 yr.	4	SE	USFS, THP, TMRA, THP, TVA and NPS	---	---	2,000	
M3-7	Assist in developing and implementing a management plan for all populations.	4.0	2	1 yr.	4	SE	USFS, THP, TMRA, THP, TVA and NPS	---	---	1,000	
04	Annually assess success of recovery program.	5.0	3	continuous	4	SE	USFS, THP, TMRS, THP, TVA and NPS	500	500	500	

APPENDIX

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