

Slender Chub
Erimystax (=Hybopsis) cahni

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



Image courtesy of USGS

**U.S. Fish and Wildlife Service
Atlanta Regional Office
Tennessee Ecological Services Field Office
Cookeville, Tennessee**

5-YEAR REVIEW **Slender Chub (*Erimystax cahni*)**

I. GENERAL INFORMATION

A. Methodology used to complete the review:

We provided public notice of this five-year review in the Federal Register (FR) on June 20, 2019 (84 FR 28850) and opened a 60-day comment period. We did not receive any public comment. We also requested any recently discovered information about the species from experts at Federal or state government agencies and non-governmental conservation organizations who have experience with this fish or might have additional information about the species (see Appendix A); we did not receive any new information from species experts. The primary source of information used in this analysis included, the final listing rule for the species under the Endangered Species Act (Act) (42 FR 45526), the recovery plan (USFWS 1983), the previous 5-year review completed for the slender chub in 2014 (USFWS 2014a), peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. All literature and documents used for this review are on file at the U.S. Fish and Wildlife Service (Service) Tennessee Ecological Services Field Office (TNFO).

We did not seek external peer review for this 5-year review because it was not considered “influential” under the Service’s policy for Information Quality Guidelines and Peer Review. Per the guidelines, the Service will seek peer review when we can reasonably determine that dissemination of influential information “...will have or does have a clear and substantial impact on important public policy or private sector decisions, and thus, a decision or action to be taken by the Director”, such as a change in listing status. This 5-year review was reviewed internally by Rose Agbalog (Virginia Ecological Services Field Office). Warren Stiles (TNFO, lead recovery biologist), completed the review. No part of the review was contracted to an outside party.

B. Reviewers:

Lead Region – South Atlantic-Gulf Region: Carrie Straight, 404-679-7726

Lead Field Office – Tennessee Ecological Services Field Office, Cookeville, Tennessee: Warren Stiles, 931-525-4977

Cooperating Region – North Atlantic-Appalachian Region: Martin Miller, 413-253-8615

Cooperating Field Office –Virginia Ecological Services Field Office, Abingdon, Virginia: Rose Agbalog: 276-623-1233 x 25

C. Background

1. FR Notice citation announcing initiation of this review:

June 20, 2019, 84 FR 28850

2. Listing history

Original Listing

FR notice: 42 FR 45526

Date listed: September 9, 1977

Entity listed: Species

Classification: Threatened

3. Associated rulemakings:

On September 13, 2007, a final rule (72 FR 52434) was published that established nonessential experimental population status for 21 species, including the slender chub, in the lower French Broad and lower Holston rivers in Tennessee. The experimental populations were to be established for future reintroductions of these threatened and endangered species in these reaches. However, the slender chub was never reintroduced to these systems.

4. Review history:

The Slender Chub Recovery Plan was published in 1983 (USFWS 1983). The recovery plan indicated that several populations had been extirpated and known populations continue to be threatened by various activities (e.g., coal mining, logging).

Each year, the Service reviews and updates listed species information in the required Recovery Report to Congress. We performed a recovery data call through 2013 that included species' status recommendations. We indicated status recommendations of "Declining" for the slender chub until 2007 and "Uncertain" from 2007 through 2013. From that point, we began to show the status recommendation for the species in the 5-year review as the status in the Recovery Report to Congress.

Summaries of the three, previous 5-year reviews are below.

Previous 5-Year Reviews

March 1982 – A slender chub 5-year status review was prepared by consultants Burkhead and Jenkins (1982) and stated that it was appropriate for the species to remain listed as "threatened".

July 29, 2008 – This 5-year review was noticed in the *Federal Register* (73 FR 43947). In this review, the statuses of 20 species, including the slender chub, were simultaneously evaluated with no in-depth assessment of threats as they pertained to the individual species. No changes in the designation of these species were identified as appropriate at that time.

March 19, 2014 – In the 2014 5-year review, we determined that the species should remain listed as “threatened” due to: (1) habitat alteration, caused by coal mining and related activities in the Clinch and Powell drainages, which continued to be the primary threat affecting the species, and (2) low population size and the potential for hybridization with similar, more numerous syntopic chubs.

5. Species’ recovery priority number at start of review (48 FR 43098):

The slender chub is assigned a recovery priority number of 5, which indicates a species with a high degree of threat and low recovery potential.

6. Recovery plan:

Name of plan: Slender Chub Recovery Plan

Date issued: July 29, 1983

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 reconsider the classification of this species with regard to designation of DPSs?** No

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes
2. **Adequacy of recovery criteria.**
 - a. **Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?** Yes
 - b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?** Yes
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.**

1. *Through protection of existing populations and/or by introductions and/or discovery of new populations, there exist viable populations in the Powell River, Clinch River, and Holston River of the following magnitude:*

- a. *Viable populations¹ exist with a minimum of seven population centers on both the Clinch and Powell rivers. These population centers will be dispersed throughout these rivers so that it is unlikely that a single event would cause the loss of a river's entire population.*
- b. *A viable population is established in the Holston River with a minimum of one population center².*

This criterion has not been met. The species has not been collected in over 20 years, though with few surveys designed to collect slender chubs specifically through targeted techniques and site selection. Most of the survey effort has been focused on sampling the fish community as a whole. As a result, there are no known, existing populations in the Clinch, Powell, or Holston rivers. No slender chub broodstock has ever been collected, which also prevents propagation and introduction efforts to accomplish this criterion. However, blotched and streamline chubs (*Erimystax insignis* and *E. dissimilis*, respectively), surrogates for slender chub, have successfully been propagated (Shute and Rakes 2001; Shute et al. 2008) and would provide a basis for developing propagation techniques for slender chub.

2. *Noticeable improvements in coal-related problems and substrate quality have occurred in the Powell River, and no increase in coal or other energy-related impacts exist in the Clinch River.*

This criterion has been partially met. Regions III and IV of the U.S. Environmental Protection Agency, the Tennessee Department of Environment and Conservation, the Virginia Department of Environmental Quality, and the Virginia Department of Mines, Minerals, and Energy signed a Memorandum of Understanding (MOU) in December 2007 to establish a working group for improving communications and coordinating efforts to protect and restore the Clinch and Powell rivers. This MOU is a coordinated response to the increasing concern over impacts to freshwater mussels and fish from coal mining in the Clinch and Powell rivers and is intended to improve water and habitat quality impacts in these watersheds. These agencies and others have demonstrated an interest in working together to accomplish the common goals of reducing human impacts associated with coal mining and processing, agriculture, urbanization, and the development of transportation corridors.

There have been some improvements in habitat quality in the Clinch and Powell rivers since the species was listed, this is evidenced by increases in the range and numbers of another federally threatened fish, yellowfin madtom, that has historically been impacted

¹ In the recovery plan, a “viable population” is defined as a population that is reproducing and either stable or expanding after ten years of population monitoring (biannual sampling).

² In the recovery plan, a “population center” is defined as a large shoal area of at least 250 square meters composed of small to medium sized gravel inhabited by a viable population of slender chubs.

by coal in these rivers (Rakes and Shute 2003, Rakes and Shute 2007, Petty et al. 2013, Mike Pinder, Virginia Department of Wildlife Resources, pers. comm. 2019). There have been no new mines in the watershed since the last review, and coal production in southwest Virginia has decreased over the last 30 years. The legacy effects of coal mining, such as deposited coal fines and dissolved metals are still affecting benthic habitats; however, the Virginia Division of Geology and Mineral Resources, predicts that coal production will continue to decline into the future, allowing the river to continue to recover (VDMME 2021).

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

This criterion has not been met. The Clinch, Holston, and Powell River watersheds are primarily in private ownership and subjected to a wide variety of land uses that negatively affect habitat in the three rivers. As a result, the species and its habitat are not protected from the human and other threats that are summarized in the Five Factor Analysis from the 2014 5-year review (pp. 10-16).

However, there has been an ongoing emphasis on conservation of the important biodiversity of the Clinch and Powell rivers among conservation organizations. Some examples of the conservation emphasis in these rivers are The Nature Conservancy's Clinch Valley Program, the multi-agency MOU referenced in criterion 2 above, which attempts to address human impacts in the Clinch and Powell watersheds, and educational programs established by Lincoln Memorial University and Virginia Department of Wildlife Resources. In addition, the two Service regions involved in these watersheds have developed a strategy (USFWS 2014b), which provides the Service a unified approach for conservation of aquatic fish and mussel biodiversity in the Upper Tennessee River Basin. These partnerships have resulted in projects reducing sedimentation from individual farms, more responsible road maintenance, and improvements in mine runoff, with habitat improvement seen in portions of the river; however, given the long history of impacts, more time is needed to see protection from all threats in any of the rivers.

C. Updated Information and Current Species Status

1. Biology and Habitat

Little new information is available regarding the biology and habitat of the slender chub, since completion of the 2014 5-year review, but new technologies may provide opportunities to detect the species at very low densities. Historically, populations of slender chubs were known from the Powell River, Clinch River, and the lower Holston River. Although no individuals have been collected for over 20 years, small populations may still exist in the Powell River and Clinch River. The last collection of the slender chub from the Holston River was in 1941 prior to the construction of Cherokee Dam, and as such, is presumed to be extirpated from the Holston River. In the Powell and Clinch rivers, Conservation Fisheries, Inc. (CFI) staff have commented that during snorkel

surveys, *Erimystax* minnows were observed, often at the edge of a snorkeler's visible range (U.S. Fish and Wildlife Service 2014a). The staff at CFI have also noted that traditional survey methods employed to date are likely only marginally effective at collecting swiftly moving, benthic minnows like *Erimystax* and suggested that other methods, such as benthic trawls and Environmental DNA (eDNA) sampling, may prove more effective. While there have been fish surveys within the slender chub's range every year since the previous review, there have been none specifically targeting this species. The only known tissue samples for the species were lost when the freezer they were stored in failed, which may make eDNA detection of slender chubs more difficult; however, molecular techniques exist that may allow for the extraction of DNA from formalin-fixed specimens. This technique has been proven viable on closely related species (Paine 2021).

New collections of yellowfin madtoms over a greater area provide evidence for some habitat improvement in the Clinch River (Mike Pinder, pers. comm. 2019). It is likely that this improvement is related to both improved mine regulations, a reduction in coal production, as well as conservation efforts in the watershed.

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

- (a) **Present or threatened destruction, modification or curtailment of its habitat or range:** Sedimentation from agriculture, silviculture, road construction, and urban development and legacy coal mine runoff continues to negatively impact the slender chub's benthic habitat in the Clinch and Powell rivers. However, improvements have been recently documented and evidenced by range extensions by the yellowfin madtom (previously discussed). The majority of the historical habitat in the Holston River was inundated by TVA's Cherokee Reservoir in 1941. While suitable physical habitat does appear to exist downstream of the dam, cold water releases from Cherokee Dam continue to make this habitat unsuitable. Limited habitat upstream of Cherokee Reservoir may be suitable for slender chub reintroductions.
- (b) **Overutilization for commercial, recreational, scientific, or educational purposes:** We have no new information indicating that this is a current threat to the species.
- (c) **Disease or predation:** We have no new information indicating that this is a current threat to the species.
- (d) **Inadequacy of existing regulatory mechanisms:** Protections afforded the slender chub through regulatory mechanisms have not changed since the 2014 status review. Existing regulatory mechanisms (e.g., Clean Water Act) have provided some improvements in water quality and habitat conditions but they have been inadequate in fully protecting the species and its habitats. Sedimentation and non-point source pollutants continue to be a chronic problem across the species' range. The information available to us at this time does not indicate that the magnitude or imminence of this threat is likely to be appreciably reduced in the foreseeable future.

- (e) **Other natural or manmade factors affecting its continued existence:** The slender chub's small population size likely exacerbates the threats to the species from habitat degradation. Small populations are more likely to have limited genetic diversity and can have reduce fitness associated with the Allee effect (reduction in individual fitness due to limited mate availability).

D. Synthesis

The recovery criteria in the Slender Chub Recovery Plan have been partially met but the species current status is precarious given the lack of positive surveys over the last 20 years. The final listing rule and the recovery plan for the slender chub both identify that the primary threat to the species is habitat alteration, much of which is associated with coal mining and related activities in the Clinch and Powell drainages. However, over the past 30 years, coal production in these watersheds have been in decline, and management of coal runoff has improved. Additionally, the expansion of yellowfin madtoms in the Clinch and Powell rivers provides evidence that habitat may be improving in these systems with the reductions in coal-related pollution. These habitat improvements offer opportunity for slender chub populations to recovery as well, but low population size still limits the species' resiliency and its potential for natural recovery.

The slender chub has not been detected since the previous status review (USFWS 2014). Extensive annual survey efforts have been conducted by TVA, TWRA, and CFI within the species' historical range and have not resulted in collection of the species from the Powell River since the early 1980s or from the Clinch River since the mid-1990s. Individuals identified as slender chubs in the Powell River by snorkelers in 2005 were not collected or confirmed, so it is not clear if populations of the species continue to exist. However, slender chub populations may still exist in the Powell River and Clinch River in spite of the lack of recent collections because of the large size of the rivers and the difficulty of capturing and identifying slender chubs.

There is a high level of uncertainty of the slender chub's status given the few verifiable detections since the 1990s. Though targeted surveys have been limited, the complete lack of specimens could be indicative of very low population numbers. While no population genetic studies have ever been carried out, the slender chub has one of the smallest ranges of any cyprinid (minnow family) in North America. The minimal new information since the last status review does not present enough evidence to warrant a status change at this time.

Planned surveys utilizing eDNA may allow us to detect the species at lower densities than traditional methods, and a pilot study to extract DNA from formalin-fixed specimens of related species has proven successful. Additional data from this new approach will help in informing the next species status review and possible reclassification.

III. RESULTS

A. Recommended Classification:

No change is needed.

B. Recovery Priority Number:

We are not recommending a change in the recovery priority number.

IV. REFERENCES

- Burkhead, N. M. and R. E. Jenkins. 1982. Five-year status review of the Slender Chub, *Hybopsis cahni*, a threatened cyprinid fish of the upper Tennessee Drainage. Report to the U.S. Fish and Wildlife Service, Newton Corner. 27 pp.
- Paine, R.T.R. 2021. Evaluation of a formalin-fixed tissue DNA extraction protocol for generating barcoding reference sequences for the *Erimystax* genus. Report from the USGS Cooperative Fishery Research Unit, Tennessee Tech University.
- Petty, M. A., P. L. Rakes, J. R. Shute, and C. L. Ruble. 2013. Restoration efforts in the Powell River of Virginia in 2012: the yellowfin madtom, *Noturus flavipinnis*, and the Slender Chub, *Erimystax cahni*. Final report to U.S. Fish and Wildlife Service Gloucester, VA Field Office (Grant Agreement #51411-B-J003, January 1, 2012 December 31, 2012). 12 pp.
- Pinder, M. 2019. Email from Mike Pinder, VDGIF, to Kathryn Smith-Hicks, TAMU, on new yellowfin madtom record in the Clinch River. 2 October 2019.
- Rakes, P. L. and J. R. Shute. 2003. Captive propagation and population monitoring of rare southeastern fishes: 2002. Unpublished final report for 2002 field season and second quarter report for fiscal year 2003 to the Tennessee Wildlife Resources Agency (Contract No. FA-99-13085-00). May 23, 2003. 36 pp.
- Rakes, P. L. and J. R. Shute. 2007. Restoration efforts in the Powell River of Virginia in 2005 and 2006: the yellowfin madtom, *Noturus flavipinnis*, and the Slender Chub, *Erimystax cahni*. Unpublished report to U.S. Fish and Wildlife Service, Gloucester, VA (Agreement #50181-4-J001). January 25, 2007. 5 pp.
- Shute, J. R. and P. L. Rakes. 2001. Captive propagation of chubs of the genus *Erimystax*. *American Currents* 27:15-16.
- Shute, J. R., M. A. Petty, and P. L. Rakes. 2008. Species Account for *Erimystax cahni*, Slender Chub. The desperate dozen: fishes on the brink. Southeastern Fishes Council Scientific Report, 2008 Edition.
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Slender Chub 5-Year Review

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Virginia Department of Mines, Minerals and Energy (VDMME). 2021. Coal in Virginia, Division of Geology and Mineral Resources, retrieved online from:
<https://www.dmme.virginia.gov/dgmr/coal.shtml>, last accessed April 24, 2021.

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Slender Chub (*Erimystax cahni*)**

Current Classification: **Threatened**

Recommendation resulting from the 5-year review:

_____ **Downlist to Threatened**
_____ **Uplist to Endangered**
_____ **Delist**
 X **No change is needed**

Review Conducted By: Ross Shaw and Warren Stiles, Tennessee Ecological Services Field Office

FIELD OFFICE APPROVAL:

Field Supervisor, Tennessee Ecological Services Field Office, Fish and Wildlife Service

Approve _____ Date _____

*Since 2014, Southeast Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.

COOPERATING REGIONAL OFFICE APPROVAL:

We emailed this 5-year review to the following regional and/or field offices for their concurrence prior to finalizing the document: Hadley, Massachusetts Regional Office and Virginia Field Office. We will retain any comments that we received, as well as verification of concurrence from other regions, in the administrative record for this 5-year review.