Grotto Sculpin
(Cottus specus)
Draft Recovery Plan

Photo of an adult Grotto Sculpin by Justin Elden/St. Louis Zoo

October 2023
U.S. Fish and Wildlife Service
Midwest Region 3
Bloomington, MN

ACKNOWLEDGMENTS

This Recovery Plan was prepared by the U.S. Fish and Wildlife Service (USFWS) (Kris Budd (USFWS Missouri Field Office), Vona Kuczynska (USFWS Missouri Field Office), Laura Ragan (USFWS Midwest Regional Office)) in collaboration with Jason Crites (Missouri Department of Conservation) and Mark Brooks (Missouri Caves and Karst Conservancy).

DISCLAIMER

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), requires the development of recovery plans for listed species, unless such a plan would not promote the conservation of a particular species. Recovery plans delineate such reasonable actions as may be necessary, based upon the best scientific and commercial data available, for the conservation and survival of listed species. The U.S. Fish and Wildlife Service (Service) publishes the plans, which are often prepared with the assistance of recovery teams, contractors, State agencies and others. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in the plan formulation other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director. Recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new information, changes in species status, and the completion of recovery actions.

Suggested citation:
U.S. Fish and Wildlife Service. 2023. Grotto Sculpin (*Cottus specus*) Draft Recovery Plan. Bloomington, Minnesota. 7 pp.

INTRODUCTION

The Service's recovery planning process entails developing a recovery plan and recovery implementation strategy (RIS). This document provides the Service's plan for the conservation and recovery of the grotto sculpin (*Cottus specus*). It describes the recovery strategy and required elements per section 4(f)(1)(B) of the Act, which are criteria, actions, and overall time and cost estimates to recovery. The RIS is a separate document from the recovery plan and is developed in cooperation with partners. It serves as an operational document for stepping down the recovery actions into specific activities needed to achieve recovery and details how, when, and where they will be accomplished. The specifics of the RIS are updated as new information becomes available through recovery implementation, a 5-year review, or some other relevant feedback.

To develop this recovery plan, we prepared a Species Status Assessment (SSA) (USFWS 2023, entire). The contents of the SSA report are as follows: (1) summary of the species' biology and life history requisites; (2) description of the influences on resource needs and viability; (3) discussion of conservation actions implemented to benefit the species and its habitat; (4) description of the subspecies' current condition in terms of resiliency, representation, and redundancy; (5) description of the projected future condition in terms of resiliency, representation, and redundancy. The SSA report is available at (https://www.fws.gov/species/grotto-sculpin-cottus-specus).

BACKGROUND

The grotto sculpin is a troglomorphic (cave adapted) fish endemic to just five cave systems in two karst areas of Perry County, Missouri. These systems include Crevice Cave, Moore Cave, Mystery Cave, Rimstone River Cave, and Running Bull Cave systems and surface systems Blue Spring Branch and Cinque Hommes Creek. These areas are characterized by thousands of sinkholes where consistent water flow, organic inputs, and connections to surface streams are sufficient such that seasonal migrations from underground streams to surface streams for the completion of the grotto sculpin's life cycle are possible (Burr et al. 2001, pp. 283-284; Fernholtz et al. 2019, p. 4).

This species was first found to be unique in 2013 (Adams et al., entire) and was federally listed as endangered shortly thereafter due to its restricted range, population isolation, and documented mortality resulting from point-source pollution of above-ground waters that drained to underground aquatic habitats (USFWS 2013, pp. 58952-58953).

The most substantial threats to grotto sculpin come from present or threatened destruction, modification, or curtailment of its habitat including water quality degradation (USFWS 2023). Potential sources and vehicles for introduction of pollution likely are industrialization, contaminated agricultural runoff, sinkhole dumps, and vertical drains installed without appropriate best management practices (USFWS 2013, p. 58952). The severity of these threats is evidenced by population-scale fish kills, likely caused by point-source pollution of surface waters that recharge cave streams where grotto sculpin reside (USFWS 2013, p. 58953). This remains an ongoing issue as fish kills occurred as recently as November 2021 in the Moore cave system; and risks of additional fish kills due to water quality deterioration and habitat siltation occur because of contaminated agricultural runoff, sinkhole dumps, industrialization, and vertical drains installed without appropriate best management practices remain. Major causes of these threats continue to pose a risk to the species and are outlined and analyzed in the listing rule (USFWS 2013, entire) and SSA report (USFWS 2023, entire).

RECOVERY STRATEGY

The recovery of the grotto sculpin is contingent on the species viability, which is defined as its ability to sustain populations in natural ecosystems within a biologically meaningful timeframe. In our SSA analysis, we used the conservation principles of resiliency, redundancy, and representation to assess viability of the grotto sculpin (USFWS 2023, entire). For populations to be resilient to stochastic events such as normal variation in temperature and rainfall as well as ongoing threats such as the effects of anthropogenic activities e.g., sedimentation and toxic chemicals from multiple sources and alterations in water flow, they need to have an abundance of individuals of multiple age classes with sufficient genetic diversity and with evidence of reproduction and recruitment of juveniles into the population (USFWS 2023, p. 7) Factors influencing resiliency of the grotto sculpin include availability of high-quality freshwater and food resources and spawning/nesting and subadult/adult habitat availability and connectivity (USFWS 2023, pp. 48-54). To withstand catastrophic events, the species needs multiple, resilient populations distributed across its historical range relative to the spatial occurrence of those potential catastrophic events (Smith et al. 2018, p. 304; USFWS 2023, p. 7). To persist or adapt in the face of changing environmental conditions, resilient populations should be distributed across the historical range of the species or the evolutionary or adaptive capacity of the species (Smith et al. 2018, p. 304; USFWS 2023, pp. 54-62).

Because the grotto sculpin currently occurs throughout its natural range, albeit highly restricted, the recovery strategy is to maintain the current number and distribution of populations while improving the resiliency of the populations to achieve long-term viability. The specific objectives to accomplish this strategy are as follows:

1. Increase the abundance of the species in areas where it currently exists.
2. Improve the overall habitat quality and quantity; specifically high-quality freshwater and food resources; spawning/nesting and subadult/adult habitat availability and connectivity
3. Protect and manage cave and surface ground water inputs that may influence the habitat quality and quantity available to the grotto sculpin.
4. Reduce likelihood of catastrophic events on the existing populations primarily from anthropogenic pollutants.
5. Maintain populations in the entirety of the species range due to its limited range, small number of populations, and thus low inherent ability to withstand catastrophic events. Furthermore, both genetic lineages (the north, which includes the Crevice and Moore cave systems, and the south which includes the Mystery, Rimstone River, and Running Bull cave systems) are necessary to maintain this genetic diversity (USFWS 2023, p. 21).

Accomplishing this strategy is contingent upon availability of funds and cooperation among private, local, state, and Federal partners with expertise in the ecology of the grotto sculpin and improvement and maintenance of its habitat.

RECOVERY CRITERIA

Recovery criteria provide objective, measurable thresholds used to indicate when recovery has been achieved. These criteria are founded on the most current scientific information available for the grotto sculpin. As new information becomes available, criteria will be re-evaluated and updated accordingly. The following recovery criteria for delisting, when met collectively, would indicate that the grotto sculpin may no longer need the protections of the Act:

A. A total of six units [five cave system units (Crevice, Moore, Mystery, Rimstone River, and Running Bull) and one surface unit (Cinque Hommes Creek) (Figure 1)] are in at least moderate condition (USFWS 2023, pp. 51-54) and have a stable or increasing population trend over a 5-year period (based on a minimum of 3 surveys in each unit).
B. Levels of anthropogenic pollutants within the six units meet or exceed thresholds for water quality that are protective of grotto sculpin over at least a 5- year period.
C. Key sources of ground and surface water inputs (e.g., sinkholes, roadway ditches, losing streams) in the recharge areas for each of the six units are managed to be protective of grotto sculpin.

Figure 1. Location of the Northern and Southern representative units (identified as "Northern RU" and "Southern RU"), which are further delineated into the five cave systems and Cinque Hommes Creek that make up the grotto sculpin home range. For more information on the units, see the Grotto Sculpin Species Status Assessment (USFWS 2023).

ACTIONS

The actions identified below are those we believe are necessary to recover the grotto sculpin, based on the best available information at this time. The recovery implementation strategy (a separate document that can be adjusted, therefore maximizing the flexibility of species recovery implementation) includes the specific operational tasks and activities required to implement these recovery actions.

1. **Protect and manage grotto sculpin populations and cave systems.** Measures may include the following:
   - Work with willing landowners and groups that access cave systems to establish guidelines for cave system entry (e.g., minimize access during grotto sculpin breeding season, gate or secure cave entrances).
   - Conduct research to understand biological and life history requisites to maintain or restore populations (e.g., longevity, survival, reproduction, dietary needs, movement).

2. **Protect and manage surface habitat in the recharge areas of the units**. Measures may include the following:
   - Identify key sinkholes and other water inputs.
   - Conduct a risk assessment on potential sources of pollutants and sedimentation.
   - Cleanup trash laden sinkholes and other potential sources of contamination.
   - Establish BMPs for sources of ground and surface water inputs (e.g., install or maintain vegetative buffers around sinkholes and riparian zones, fence entrances to restrict cattle access, inground filtration system, baffle boxes, improve management of runoff from roadways).
   - Work with willing stakeholders to protect key sources of surface and ground water inputs (e.g., through land acquisition, easements, and incentive programs) and encourage implementation of BMPs.

3. **Improve and monitor water quality in each unit**. Measures may include the following:
   - Determine the effects of anthropogenic pollutants and the maximum threshold level allowance for grotto sculpins (e.g., surface applied chemicals, sediment, livestock and human waste, *E. coli*).
   - Conduct water quality monitoring to ensure water quality standards are being met.

4. **Assess resiliency factors** (per SSA; USFWS 2023, pp. 24-44) **and population trends through monitoring and surveys in each unit**. Measures may include the following:
   - Secure access to units for monitoring.
   - Establish standardized monitoring protocols to track resiliency factors and population trends over time.
   - Complete surveys within each unit based on established protocols.
   - Incorporate centralized database or shared data agreement between conservation partners to compile historical and continued monitoring results.

5. **Conduct educational and public outreach** to heighten awareness of the species and its importance as an indicator of community water quality.

ESTIMATED TIME AND COST OF RECOVERY

The estimated costs of implementing recovery actions for delisting are $1,825,000 (Table 1). Some costs, such as specific cost for land acquisition, are not determinable at this time, and therefore the total cost may be higher than this estimate. If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, we anticipate delisting could be achieved within 40 years following adoption of this plan. We note that the recovery program may change over time, or the timeframe estimated to implement the recovery actions to achieve recovery may take shorter or longer than expected.

Table 1. Actions the Service believes are necessary to move towards recovery of the grotto sculpin and estimated costs of implementation.

Recovery Actions (Year 2023 to 2038)	Estimated Cost
1. Protect and manage grotto sculpin populations	$140,000
2. Protect and manage surface habitat in recharge areas	$1,000,000[1]
3. Improve and monitor water quality	$265,000
4. Assess resiliency and population trends through monitoring and surveys	$220,000
5. Conduct educational and public outreach	$200,000
Total estimated cost of recovery actions	**$1,825,000**

[1] Does not include undetermined costs for potential land acquisition, conservation easements and landowner incentive programs, as those are situation-specific and difficult to estimate.

LITERATURE CITED

Adams, G.L., B.M. Burr, J.L. Day, and D.E. Starkey. 2013. *Cottus specus*, a new troglomorphic species of sculpin (Cottidae) from southeastern Missouri. Zootaxa 3609:484–494.

Burr, B.M., G.L. Adams, J.K. Krejca, R.J. Paul, and M.L. Warren, Jr. 2001. Troglomorphic sculpins of the *Cottus carolinae* species group in Perry County, Missouri: distribution, external morphology, and conservation status. Environmental Biology of Fishes 62:279–296.

Fernholtz, J., S. De Silva, M. Chowning, M. Sobotka, and J. Crites. 2019. The Population Ecology and Status of Grotto Sculpin, *Cottus specus*, in Perry County, Missouri. CA 87 Final Report submitted to Missouri Department of Conservation. 105 pp.

Smith, D.R., N.L. Allan, C.P. McGowan, J.A. Szymanski, S.R. Oetker, and H.M. Bell. 2018. Development of a species status assessment process for decisions under the U.S. Endangered Species Act, Journal of Fish and Wildlife Management 9(1):302–320.

U.S. Fish and Wildlife Service (USFWS). 2013. Endangered and threatened wildlife and plants; Determination of endangered species status for the grotto sculpin (*Cottus specus*) throughout its range. Federal Register 78:58938–58955, September 25, 2013.

U.S. Fish and Wildlife Service (USFWS). 2023. Grotto sculpin (*Cottus specus*) Species Status Assessment. Version 1.0., 2023. Bloomington, MN. 74 pp. + appendices