Recovery Plan for the Grotto Sculpin (*Cottus specus*)

Photo by Justin Elden, St. Louis Zoo

November 2024
U.S. Fish and Wildlife Service
Region 3
Bloomington, MN

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Prepared by the
Grotto Sculpin Recovery Planning Team

for

Region 3
U.S. Fish and Wildlife Service
Bloomington, Minnesota

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Approved: WILLIAM MEEKS Digitally signed by WILLIAM MEEKS Date: 2024.11.16 08:03:36 -06'00'

Regional Director, Region 3
U.S. Fish and Wildlife Service

PURPOSE AND DISCLAIMER

This document presents the U.S. Fish and Wildlife Service's (Service) plan for the conservation of the grotto sculpin. The recovery plan is the second part of the Service's 3-part recovery planning framework and includes the statutorily required elements pursuant to section 4(f) of the Endangered Species Act (Act). This recovery plan is informed by the first part of the framework, a Status Assessment (SSA). The SSA report delivers foundational science for informing Species decisions related to the Act and includes an analysis of the best available scientific and commercial information regarding a species' life history, biology, and current and future conditions that characterizes the species' viability (i.e., ability to sustain populations in the wild over time) and extinction risk. The third part of the framework is the Recovery Implementation Strategy (RIS). The RIS is an easily updateable operational plan that is separate and complimentary to the recovery plan that details the on-the-ground recovery activities needed to complete the recovery actions contained in the recovery plan.

Recovery plans describe the envisioned recovered state for a listed species (when it should no longer meet the Act definitions of a threatened species or endangered species) and includes a recovery strategy, recovery criteria, recovery actions, and the estimates of time and cost needed to achieve it. Plans are published by the Service and 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 plan formulation, other than that of the Service. They represent the official position of the Service only after they have been signed by the Regional Director as approved. Recovery plans are guiding 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 findings, changes in species status, and completion of recovery actions.

ACKNOWLEDGMENTS

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INTRODUCTION

This recovery plan describes criteria for determining when the grotto sculpin (*Cottus specus*) should be considered for delisting, lists site-specific actions that will be necessary to meet those criteria, and estimates the time and cost to achieve recovery. Additionally, summary information on the species' biology and a brief discussion on factors limiting populations are included. This recovery plan was informed by the Species Status Assessment (SSA) for the Grotto Sculpin (USFWS 2024a, entire). SSA's provide a more detailed account of the species' status, distribution, biology, and threats. The contents in an 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. Detailed on the ground activities implementing recovery actions are found in the Recovery Implementation Strategy (RIS). The RIS 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. These supplemental documents are available on the species profile page located within the USFWS Environmental Conservation Online System website (https://ecos.fws.gov/ecp/species/1009). The SSA and RIS are finalized separately from the Recovery Plan and can be updated on a routine basis.

BACKGROUND

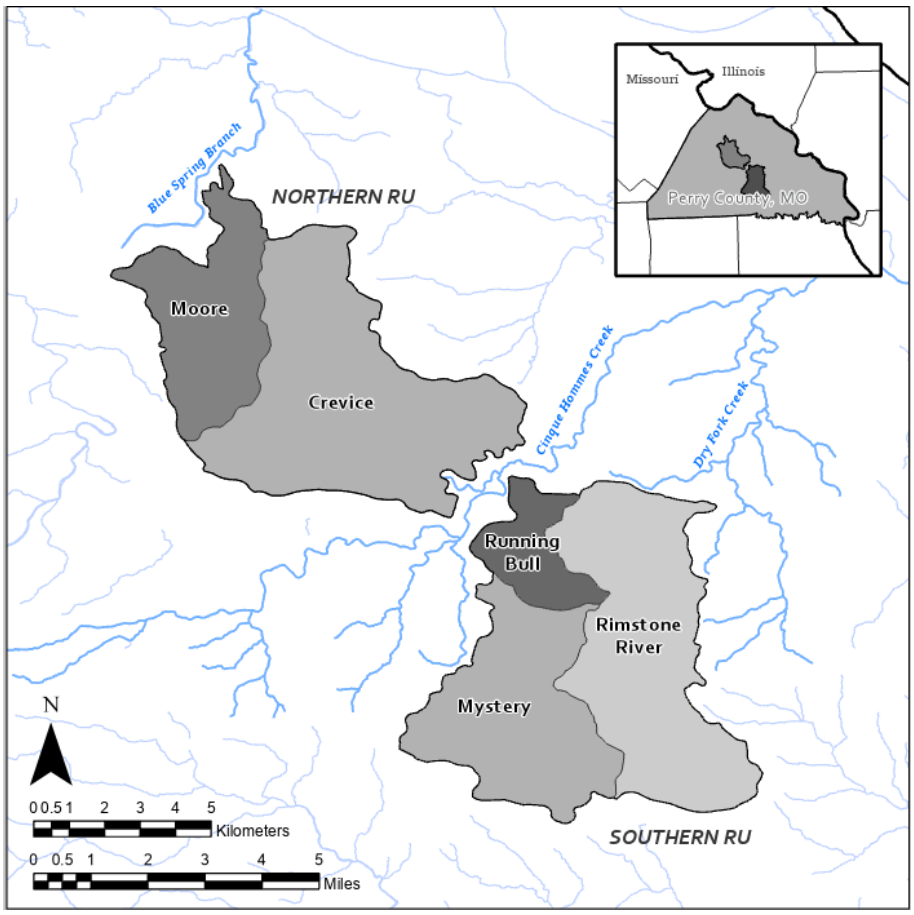
The grotto sculpin is a troglomorphic (cave adapted) fish endemic to just five cave systems and their corresponding resurgence streams in two karst areas of Perry County, Missouri. These systems include Crevice Cave, Moore Cave, Mystery Cave, Rimstone River Cave, and Running Bull Cave systems and Blue Spring Branch, Cinque Hommes Creek, and Dry Fork Creek surface streams (Figure 1). 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 to complete the grotto sculpin's life cycle are possible (Burr et al. 2001, pp. 280–281; Fernholtz et al. 2019, pp. 4–5; USFWS 2013, entire).

This species was first found to be unique in 2013 (Adams et al. 2013, 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 2024a, pp. 23–39). Potential sources and vehicles for introduction of pollution into the streams are industrialization, contaminated agricultural runoff, and sinkhole dumps (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. 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 2024a, entire).

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 as well as the three associated streams that make up the grotto sculpin range. For more information on the units, see the Grotto Sculpin Species Status Assessment (USFWS 2024a, pp. 10–15).



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 2024a, entire). To withstand "stochastic" events (e.g., normal variation in temperature and rainfall throughout the years, occasional droughts or floods), sculpin require sufficient genetic diversity that allow individuals adapted to certain environmental and habitat conditions to survive. To withstand ongoing threats (e.g., humans introducing pollutants into sinkholes or directly into streams), grotto sculpin need

to have an abundance of individuals of multiple age classes throughout each cave system, with evidence of reproduction and recruitment of juveniles into the population (USFWS 2024a, p. 7) so that it is unlikely that a threat will result in the death or injury to a large portion of a population.

Factors influencing resiliency of the grotto sculpin include availability of high-quality freshwater, food resources, as well as spawning/nesting and subadult/adult habitat availability and connectivity between them (USFWS 2024a, pp. 47–51). 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 2024a, p. 22). 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 2024a, pp. 50–57).

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. 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 genetic diversity (USFWS 2024a, p. 22).

The specific objectives to accomplish this strategy are as follows:

1. Maintain or increase the abundance of the species in areas where it currently exists.
2. 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.
3. Protect and manage cave and surface ground water inputs that affect grotto sculpin habitat.
4. Reduce likelihood of catastrophic events stemming from introductions of chemicals and pollutants into sinkholes and streams.

Accomplishing this strategy is contingent upon cooperation among many private, local, state, and Federal partners, including support from Perry County's citizens, such as local farmers, industry leaders, real estate managers, business owners, as well as the local farm bureau, elected government officials, local technical contractors, and many other individuals and groups. Recovering the grotto sculpin is also contingent on availability of funds and improvements to and sustained maintenance of its habitat.

RECOVERY CRITERIA

Recovery criteria are statutorily required objective, measurable descriptions of a recovered state for the grotto sculpin, as described in 4(f)(1)(b)(ii) of the Act. Recovery criteria describe the conditions of resiliency, redundancy, representation, and threat abatement that indicate when the grotto sculpin may no longer meet the Act's definitions of an endangered species or threatened species. Recovery criteria present our best estimate of a species' recovered condition at the time

of recovery plan development. Changes in available information, technologies, and our understanding of the species over time might mean that the recovered state envisioned by the recovery criteria differs from our assessment in a later status determination.

The recovery criteria for the grotto sculpin are founded on the most current scientific information available. If substantive new information becomes available, criteria may be re-evaluated and updated accordingly through a recovery plan revision. Additionally, access to grotto sculpin caves is provided entirely by private entities and landowner access is required to measure thresholds. If access to certain cave systems cannot be obtained by an agency or partners, alternative metrics for recovery may be developed or assumptions may need to be made based on limited available information.

The following recovery criteria for delisting, when met collectively, may indicate that the grotto sculpin no longer needs the protections of the Act:

Delisting criteria

Due to genetic differences between the Northern and Southern representative units, we consider both representative units necessary to maximize the evolutionary potential of the species. Given the small range of the populations, the persistence of all populations (i.e., represented by the six analysis units) is also necessary to guard against extinction from catastrophic events. Therefore, the grotto sculpin may be considered for delisting when the following objective, measurable criteria are achieved. The criteria pertain to all six analysis units (i.e., the five cave systems (Crevice, Moore, Mystery, Rimstone River, and Running Bull) and the main surface stream where sculpin are known to occur (Cinque Hommes Creek).

A. One analysis unit in the Northern representative unit and one in the Southern representative unit exhibit high resiliency over a 10-year period, and the other four analysis units have at least moderate resiliency, as defined in the Grotto Sculpin Species Status Assessment (USFWS 2024a, pp. 45–50).
B. Levels of anthropogenic pollutants within all six analysis units meet or exceed water quality thresholds that are protective of grotto sculpin over at least a 10-year period (based on a minimum of 6 water quality surveys in each unit over the 10-year period). Water quality standards are identified in the Grotto Sculpin Monitoring Plan (USFWS 2024b, entire).
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 identified and managed to be protective of grotto sculpin. Key sources of ground and water inputs will be identified in a risk assessment for the grotto sculpin.
D. Conservation plans or other conservation commitments are in place and include strategies to ensure that grotto sculpin populations and habitats are conserved into the future.

ACTIONS

The actions identified below are those that the Service believes 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. Priority 1 actions are based on currently available information that suggests those actions must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 actions are those that must be taken to prevent a significant decline in population size or habitat quality or some other significant negative impact. Priority 3 actions are all other actions necessary to provide for full recovery of the species. The assignment of priorities does not imply that some recovery actions are of low importance but recognizes that lower priority items may be deferred while higher priority items are being implemented. All of the actions pertain to all six analysis units (i.e., the five cave systems (Crevice, Moore, Mystery, Rimstone River, and Running Bull) and one surface stream (Cinque Hommes Creek).

Several conservation actions are already in progress to protect the grotto sculpin and its habitat. Key measures include acquiring and safeguarding cave entrances, cleaning out contaminants and stabilizing numerous sinkholes to prevent erosion, and conducting workshops on Best Management Practices for water quality and soil erosion. A water quality committee was established to evaluate and enhance conditions in recharge areas following the sculpin's listing. Additionally, the Perry County Community Conservation Plan has been developed to promote various conservation efforts benefiting the grotto sculpin. For a detailed list of ongoing and completed efforts, refer to Appendix B of the Grotto Sculpin Species Status Assessment (USFWS 2024a, pp. 80–86).

1. **Protect grotto sculpin and their habitat within the cave systems.** (Priority Action 1)

   Measures may include the following:
   - Develop an understanding of how often areas inhabited by grotto sculpin are accessed due to research, mapping trips, tourism, and recreational cave use.
   - Develop an understanding of how cave use activities affect grotto sculpin habitat.
   - Work with willing landowners and groups that access cave systems to establish recommendations for cave system use (e.g., minimize foot traffic through grotto sculpin areas during breeding season in areas where eggs may be attached to substrates and could be crushed by people walking through systems).
   - Work with willing landowners and groups to secure cave access through land acquisitions, easements, management plans, or other forms of protections.

2. **Conduct research to understand biological and life history requisites to maintain or restore populations** (e.g., habitat requirements for foraging, shelter, and breeding, information on longevity, survival, reproduction, dietary needs, movement, and genetics). (Priority Action 1)

Measures may include the following:
- Develop better understanding of how sedimentation affects grotto sculpin habitat selection or avoidance.
- Develop better understanding of genetic representation within the analysis units.
- Establish a captive breeding population for the purposes of attaining additional life history information, such as longevity, and other research needs.

3. **Protect and manage surface habitat within the recharge areas**. (Priority Action 1)

   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.

4. **Improve and monitor water quality in each unit**. (Priority Action 1)

   Measures may include the following:
   - Determine which anthropogenic pollutants are present in grotto sculpin habitat throughout the year.
   - Determine the effects of anthropogenic pollutants and the maximum threshold level allowances for grotto sculpins (e.g., surface applied chemicals, sediment, livestock and human waste, *E. coli*).
   - Conduct water quality monitoring at least 3 times in every 5-year period during times when pollutants are likely to be at their highest levels.

5. **Monitor populations in each unit to assess resiliency factors** (per SSA, USFWS 2024a, pp. 45–50; and per Grotto Sculpin Monitoring Plan, USFWS 2024b, entire). (Priority Action 1)

   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.

6. **Conduct educational and public outreach** to heighten awareness of the species and its importance as an indicator of community water quality. (Priority Action 2)

ESTIMATED TIME AND COST OF RECOVERY

The estimated costs of implementing recovery actions for delisting are $4,090,000 (Table 1). Some costs, such as specific costs for all potential land acquisition and activities that may be implemented as future research informs practices to reduce the effects of threats, 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 full implementation of the actions to take approximately 10–15 years and recovery could be achieved within an additional 10 years, thus a total of 20–25 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	Priority Number	Estimated Cost
1. Protect grotto sculpin and their habitat within the cave systems	1	$200,000
2. Conduct research to understand biological and life history requisites to maintain or restore populations	1	$300,000
3. Protect and manage surface habitat within the recharge areas	1	$3,000,000
4. Improve and monitor water quality in each unit	1	$400,000
5. Monitor populations in each unit to assess resiliency factors	1	$50,000
6. Conduct educational and public outreach	2	$140,000
Total Estimated Cost of Recovery		**$4,090,000**

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). 2024a. Grotto sculpin (*Cottus specus*) Species Status Assessment. Version 1.1., 2024. Bloomington, Minnesota. 74 pp. + appendices.

U.S. Fish and Wildlife Service (USFWS). 2024b. Grotto sculpin (*Cottus specus*) Monitoring Plan. 2024. Draft available through the Missouri Ecological Services Field Office in Columbia, Missouri.