

Pygmy Sculpin
(*Cottus paulus* [=pygmaeus])

5-Year Status Review:
Summary and Evaluation



Pygmy Sculpin. Photo by Jenna Crovo. 2020 Outdoor Alabama Photo Contest

U.S. Fish and Wildlife Service
Atlanta Regional Office
Alabama Ecological Services Field Office
Daphne, AL

June 2024

STATUS REVIEW
Pygmy Sculpin (*Cottus paulus* [=pygmaeus])

GENERAL INFORMATION

Current Classification: Threatened

Lead Field Office: Alabama Ecological Services Field Office: Scott Lamont, 251-395-2353

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Reviewers:

Lead Regional Office: Atlanta Regional Office, Carrie Straight, (404) 679-7226

Date of original listing: October 30, 1989 (54 FR 39846; September 28, 1989)

Methodology used to complete the review:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants ([50 CFR 424.11](#)). The U.S. Fish and Wildlife Service (Service) evaluated the best available information about the biology, habitat, and threats of the pygmy sculpin to inform this status review.

In conducting this 5-year review, the Service relied on the best available information pertaining to historical and current distributions, life history, ecology, and habitat of this species. We announced initiation of this review in the Federal Register on May 7, 2018 (83 FR 20092) with a 60-day comment period. We received no public comments during the open period. The primary sources of information used in this analysis were the species' recovery plan (Service 1991), the last five-year review (Service 2008), recent studies of the species, peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. This review was completed by the U.S. Fish and Wildlife Service, Alabama Ecological Services Field Office (ALFO), Daphne, Alabama. All literature and documents used for this review are on file at the ALFO. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the pygmy sculpin.

FR Notice citation announcing the species is under active review:

May 7, 2018 (83 FR 20092)

Species' Recovery Priority Number at start of 5-year review ([48 FR 43098](#)):

8. The pygmy sculpin is a species exposed to moderate level of threats and has a high potential for recovery.

Review History:

A previous 5-year review recommending no change in status was signed on July 28, 2008 (Service 2008).

REVIEW ANALYSIS**Listed Entity****Taxonomy and nomenclature**

The pygmy sculpin was listed in 1988 using the Latin binomial *Cottus pygmaeus*. However, it was subsequently found that this name was already attributed to another species. Therefore, the taxonomy was revised to *Cottus paulus* to adhere to nomenclature standards (Williams 2000). This updated nomenclature does not impact our assessment of the listed entity, and it is still considered a valid entity by the Service. Until we finalize a technical correction of the name, we will continue to reference the species using the name as it was listed.

Distinct Population Segment (DPS) ([61 FR 4722](#))

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This species was not listed as a DPS, and we have no new information that would indicate the species should be listed as a DPS under the Service's 1996 DPS Policy.

Recovery Criteria**Recovery Plan or Outline**

Pygmy sculpin (*Cottus pygmaeus*) Recovery Plan, August 6, 1991

Recovery plans are not regulatory documents and intended to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer requires protections under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act ([84 FR 45020](#)).

The recovery plan presents recovery objectives and criteria simultaneously as follows:

“The objectives of this plan are: (1) to prevent the pygmy sculpin from becoming endangered, and (2) to delist the pygmy sculpin. The first recovery objective will be satisfied when all recovery tasks have been fully implemented. Delisting should be considered when all recovery tasks have been fully implemented and five years of consecutive data indicate the existence of five or more protected, viable populations in separate drainages fed by tree or more separate aquifers.

Protected is defined as having enough control over the area of surface drainage and groundwater recharge supporting the aquatic habitat so that adverse impacts are unlikely to occur.

A viable population is defined as having the reproductive capability to sustain itself in perpetuity without immigration of individuals from other populations.”

Current available data support the hypothesis that the pygmy sculpin is endemic to Coldwater Spring in Calhoun County, Alabama. Since this species' natural range is expected to be a single site, expecting multiple populations may no longer be appropriate. Criteria in the recovery plan for the pygmy sculpin are contingent on the completion of all recovery tasks and multiple populations which may not reflect the current evolutionary history of the species. At this time no criteria have been met.

Biology and Habitat Summary

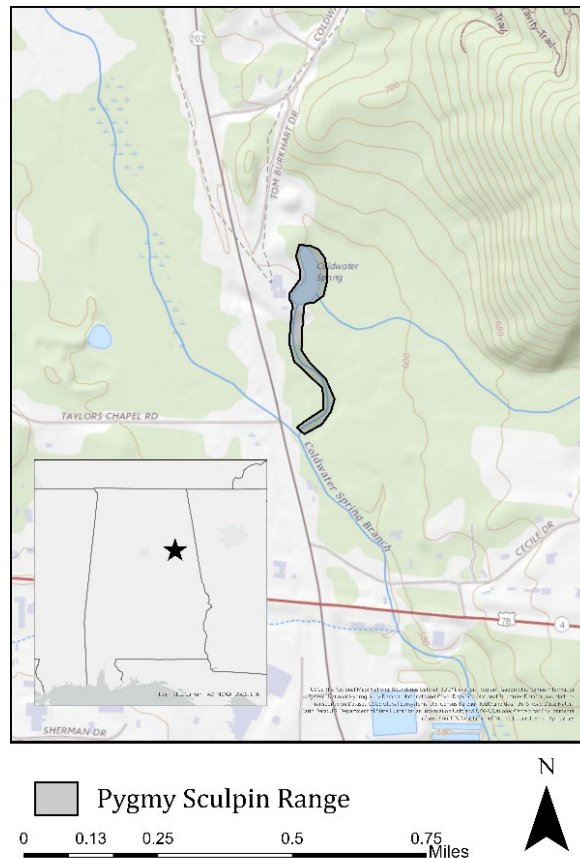


Figure 1. Range of the pygmy sculpin in Calhoun County, AL.

A detailed review of the species' biology and habitat information can be found in the previous 5-year status review of this species (Service 2008). Since the previous 5-year review, the pygmy sculpin has continued to be observed in Coldwater Spring and the spring run in Calhoun County, Alabama (Figure 1). Coldwater Spring is impounded by a low weir dam to form a pool of over 0.4 hectares (1 ac), 0.6 to 1.2 m deep (2 to 4 ft). The spring run is up to 18 m (60 ft) wide and 152 m (500 ft) long to its confluence with Dry Creek. The average flow is 121 million liters (32 million gallons) per day with a fairly constant temperature of 16° to 18° C (61° to 64° F).

In 1973 the population of pygmy sculpins in the Coldwater Spring run was estimated at 2,250 to 2,700 individuals (Service 1991). However, the abundance of the pygmy sculpin in Coldwater Spring pool was not estimated. Estimates by Catchings (1992) ranged from 1,710 to 2,722 in the

spring pool and as many as 5,392 in the spring run. Stiles (1999) estimated the population numbers of pygmy sculpins within the spring pool from 1997 to 1998 to be as high as 25,000 individuals, and within the spring run, during the same time, as high as 2,500. In 2014, a long-term sampling protocol was developed (Matechik 2014). Subsequently, the Alabama Department of Conservation and Natural Resources (ADCNR), Division of Wildlife and Freshwater Fisheries implemented methods from the sampling protocol and provide estimates of density as individuals per square meter (Figure 2) from 2015-2018 (Rider et al. 2016; Rider and Miles 2017; Rider and Miles 2018). Additional densities of pygmy sculpin were provided by Tetra Tech (2023) which implemented a sampling methodology that was modified from Matechik 2014 (Figure 2). Generally, methods recommended by Matechik (2014) and implemented by ADCNR estimate a mean number of the pygmy sculpin calculated per square meter at 50 randomly selected quadrates in Coldwater Spring run and in the spring pool. In the spring pool, densities were estimated by cobble and nostoc (defined as a mixture of sand, algae, and cyanobacteria) habitat types and excluded vegetated habitats from analysis. TetraTech modified these methods by utilizing an underwater drone that selected 50 unique quadrates that were 0.5 meter² and included vegetated habitats in the survey. Using these modified methods, TetraTech estimated a population size that ranged from 12,361 in December 2020 to 22,662 in December 2021. Based on approximately seven years of data, mean densities appear consistent. However, statistical significance testing has not been conducted and the modified methods implemented after 2020 cannot be compared to data collected between 2015 and 2018.

We are not aware of any additional new biology or habitat information since the most recent species review that impacts the status of the species and all of information provided in the last 5-year review remains valid (Service 2008).

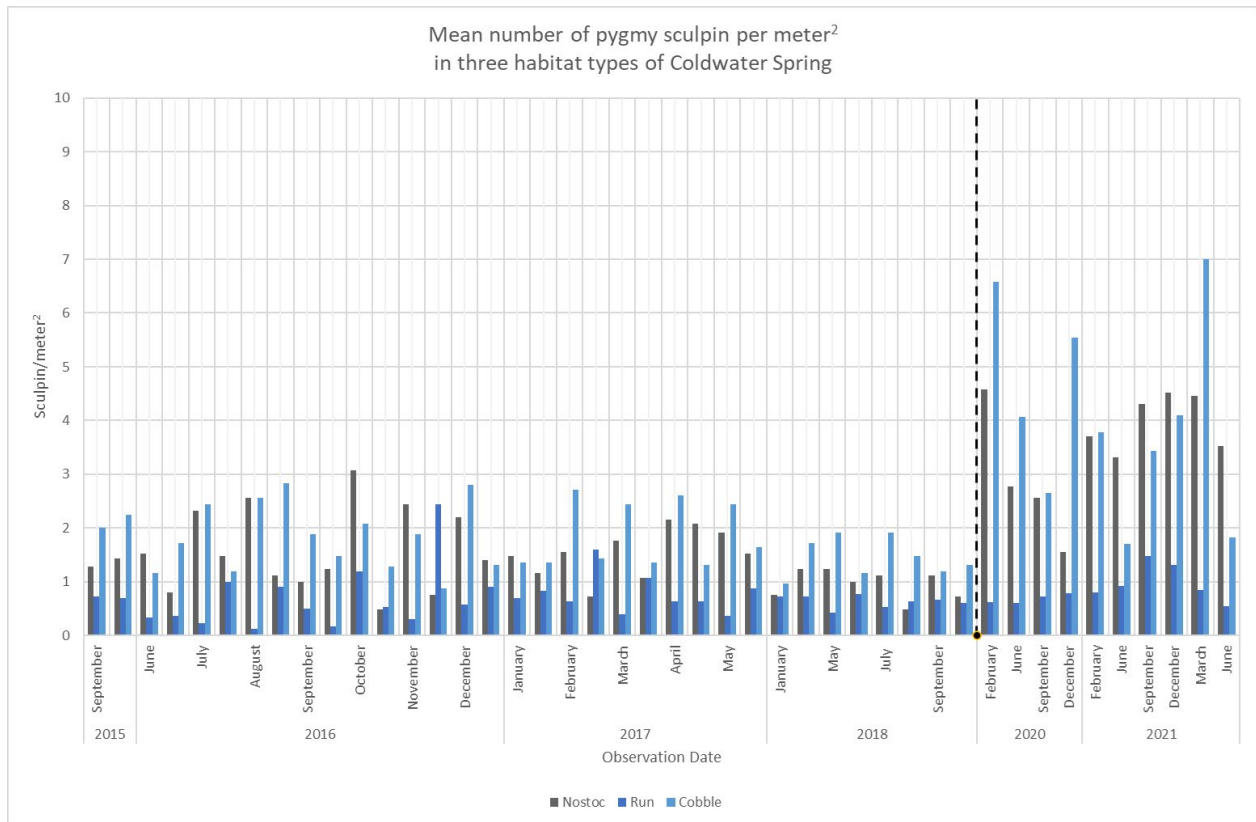


Figure 1. Mean number of pygmy sculpin observed in a square meter of three habitats in Coldwater Spring. The vertical dashed line indicates differing methods. Prior to year 2000, two observers estimated density per month, and after 2000 methods were modified to include different habitats and smaller quadrates sizes therefore they are presented separated by this line.

Threats (Five-Factor Analysis) Summary

The status of a species is determined from an assessment of factors specified in section 4 (a)(1) of the Act, including: Factor A: the present or threatened destruction, modification, or curtailment of its habitat or range; Factor B: overutilization for commercial, recreational, scientific, or educational purposes; Factor C: disease or predation; Factor D: the inadequacy of existing regulatory mechanisms; Factor E: other natural or manmade factors affecting its continued existence. A summary of this assessment is detailed below.

Factor A: Present or threatened destruction, modification or curtailment of its habitat or range

Groundwater contamination remains the greatest threat to the pygmy sculpin. The U.S. Geological Survey determined the recharge area for Coldwater Spring to be approximately 90 square miles, which includes a portion of the Anniston Army Depot (Depot), Cities of Anniston, Jacksonville and Oxford, Fort McClellan, and other suburban areas. The importance of protection of the recharge area (Valley and Ridge Aquifers) is essential to the survival of the species. In 2004, water percolating from the spring was determined to be around 15 years old and of excellent quality and the large volume of discharge, low variability of flow, and low lag time between drought and fluctuations in discharge are all consistent with a spring that flows from a deep, regional source of water (Robison 2004). However, within the Coldwater Spring recharge area, the aquifer is vulnerable to point source and non- point source pollution, urbanization, and

changes in watershed geomorphology. Contaminates identified in the previous review such as trichloroethylene continue to be observed in Coldwater Spring (Service 2008) and have increased from the 3.4 ppb documented at the time of listing to above the 5.0 maximum contaminant level since 2003 with the highest concentration of 13.5 ppb recorded in June 2021 (TetraTech 2023). Trichloroethylene is known to occur at high concentrations (up to 120,000 ppb) in test well on the Depot (Service 2000). Trichloroethylene is a known carcinogen, can impact the nervous system, and result in reduced hatching success, altered larval morphology and behaviors in a study fish species, and we could see similar impacts to pygmy sculpin with prolonged exposure or high levels of the pollutant (Horzmann et al. 2020). In 2011, the U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC) assessed the response of banded sculpin (*Cottus bairdi*) to varying concentrations of trichloroethylene as a surrogate for pygmy sculpin in 2011. The results of this research found the lowest observed adverse effect level (LOAEL) of trichloroethylene on banded sculpin occurred at a concentration of 2,705µg/L (TetraTech 2016). While this data is useful for understanding potential risk, caution should be exercised in using it to infer concentrations of trichloroethylene that would induce an adverse response in the pygmy sculpin.

Factor B: *Overutilization for commercial, recreational, scientific, or educational purposes*

We have no evidence that overutilization for commercial, recreational, scientific, or educational purposes are currently a threat to the species.

Factor C: *Disease or Predation*

A number of species that are potential predators of the pygmy sculpin occur within Coldwater Spring such as water snakes (*Nerodia spp.*), chain pickerel (*Esox niger*), and banded sculpin (*Cottus carolinae*), though, direct evidence of such interactions is scant. Further, Williams (1968) noted that the banded sculpin was restricted to the “edge of the spring” and found this to be “significant”. In contrast, the pygmy sculpin was found to be the most abundant species of fish throughout Coldwater Spring (Williams 1968). Adult pygmy sculpins are known to occasionally feed upon conspecific sculpin eggs. Males have been observed to consume entire clutches of eggs when taking over existing nests during brooding (Johnston 2000). Crayfish (such as *Cambarus latimanus*) also eat pygmy sculpin eggs (Johnston and Knight 2004). Crayfish are observed frequently and appear to occur at high densities in Coldwater Spring. While predation likely occurs, we currently do not have any information to indicate that mortality due to predation is excessive and resulting in negative population growth rates. Similarly, there is no evidence to suggest that disease poses a threat to the species at-this-time.

Factor D: *Inadequacy of Regulatory Mechanisms*

The pygmy sculpin and its habitats are afforded some protection through various federal and state laws. The species is also afforded some protection from water quality and habitat degradation under the Clean Water Act of 1972 (33 U.S.C. 1251 et seq.) and the Alabama Water Pollution Control Act, as amended, 1975 (Code of Alabama, §§ 22-22-1 to 22-22-14). However, the recent rulings defining the waters of the United States (88 FR 61964) excludes groundwater. There exists no preference for groundwater allocation in Alabama for different water uses such as domestic, agricultural, industrial, or mining at a rate of 100,000 gallons or more per day (Andreen 2016). Because of this, landowners may extract water on private land from the same

aquifer systems that supplies the habitat for the pygmy sculpin. Excessive water withdrawal could reduce quantity of available habitat or influence concentrations of pollutants by reducing pollution dilution capacity.

At the time of listing, the use of Coldwater Spring as a drinking water supply for the City of Anniston was believed to provide some level of protection for the pygmy sculpin. While it is true that this use encourages maintenance of good water quality and mindful allocation, the species may not benefit from actions implemented to ensure safe water is delivered to the public. For instance, the Anniston Water Works and Sewer Board utilizes equipment to remove trichloroethylene (present in Coldwater Spring) from the water at the treatment plant prior to transport to the public. However, the pygmy sculpin remains exposed to the chemical in the spring.

Factor E: *Other Natural or Manmade Factors*

The low weir dam reduces movement between individuals in the spring run and the spring pool, effectively isolating the spring pool population from any genetic contributions to the pygmy sculpins in the spring run population. Isolation of the spring pool population may, over time, lead to inbreeding depression and the expression of undesirable alleles, which may result in reduced survival and fertility of impacted individuals.

Numerous natural and manmade factors could affect the continued existence of the pygmy sculpin. This highly endemic species with an extremely localized range makes it vulnerable to extinction from catastrophic events, such as toxic spills, changes in flow regime, and changes in aquifer recharge due to pumping for public water supply. Additionally, although more research will need to be conducted in this area, concerns from climate change on flow rates/flood cycles could be a concern.

Climate changes that are and will be impacting Alabama also have the potential to impact pygmy sculpin. In the future temperatures are expected to increase and annual precipitation is highly variable (Runkle et al. 2022). These two variables taken individually or together could result in negative impacts on the species, with increases in temperature resulting in changes outside of the biological thresholds for the species discussed above and with periodic drought potentially impacting habitat availability and resulting in reduced survival of individuals or reduced reproductive success. Loss of habitat availability for nests may result in increased intraspecific nest predation as individuals take over nesting spaces. Alternatively extreme precipitation events could wash pollutants from headwaters and other areas within the watershed down into habitats the species is using and decrease survival and reproductive success. In the near future additional information will help the Service determine if these impacts will negatively impact the species viability.

Synthesis

The pygmy sculpin is endemic to the Coldwater Spring (spring pool and spring run), in Calhoun County, AL. Reaching a length of approximately 1.5 inches, the pygmy sculpin is the smallest member of its genus in North America. Its combination of light and dark mottling and banding

helps it blend into the substrate of Coldwater Spring, the only location where it occurs. There has been no significant change in the status of the pygmy sculpin since it was listed under the Act on September 28, 1989. Density estimates within Coldwater Spring show year-to-year variability but appear stable and the species is not interpreted to have experienced significant curtailment of population size, range and habitat. However, deterioration of water quality within Coldwater Spring's 90 square mile recharge area has continued, with notable increasing concentrations of trichloroethylene since the time of listing. The extremely small range of the pygmy sculpin makes it vulnerable to random natural or human induced events such as spills and groundwater contamination. A rapid increase in contaminants could have catastrophic effects on the species and continued declines in water quality could begin to reduce fitness of individuals. The continued human population growth and anticipated development is likely to introduce additional stressors that would compound with current stressors such that the future viability of the pygmy sculpin remains reduced. Therefore, we believe the pygmy sculpin continues to meet the definition of threatened species under the Act.

RECOMMENDED FUTURE ACTIVITIES

A detailed discussion of recovery actions and criteria are presented in the Recovery Plan (Service 1991). In the course of this status review new and/or targeted potential recovery activities were identified and are included below.

Recovery Activities

- Continue working closely with the Anniston Water Works and Sewer Board regarding:
 - Water extraction, quality and quantity.
 - Watershed management practices for the pygmy sculpin.
- Existing regulations and land management laws within the recharge area should be enforced.
- Develop a comprehensive land use and impact database and conservation strategy on the 90 square mile recharge area of Coldwater Spring. Work through various agreements, memorandums of understanding, partnerships and funding mechanisms, with private landowners, municipalities, Calhoun County, State of Alabama and Federal Agencies such as the Natural Resources Conservation Service, Environmental Protection Agency, and Department of the Army, to protect the recharge area.
- Captive propagation work
 - Plan should be developed.
 - Propagation studies and efforts should be undertaken to bolster redundancy.
- A disaster recovery program for the species should be developed and implemented; such a plan should include incorporation of an ark population in aquaria or the development of a surrogate spring refugia.

Monitoring and Research Activities

- A consistent monitoring plan should be continued for the pygmy sculpin and Coldwater Spring recharge area.

- Research to understand the effects of contaminants present or likely to become present in Coldwater Spring on the pygmy sculpin or other species of the genus *Cottus* as a surrogate should be conducted.

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RECOMMENDATIONS / SIGNATURES

U.S. Fish and Wildlife Service Status Review of Pygmy Sculpin

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

- Downlist to Threatened
- Uplist to Endangered
- Delist:
 - The species is extinct*
 - The species does not meet the definition of an endangered or threatened species*
 - The listed entity does not meet the statutory definition of a species*
- No change needed

New Recovery Priority Number ([48 FR 43098](#)):

The species original Recovery Priority Number was 8, indicating a species with moderate degree of threats and a high recovery potential. We recommend a new recovery number, 11, indicating a species with a moderate degree of threat and a low recovery potential. As described in this document, the primary threats to this species come from groundwater contamination. Groundwater hydrology is poorly understood, and the threat is pervasive across the known range of the pygmy sculpin and difficult to alleviate without creative or experimental techniques.

FIELD OFFICE APPROVAL:

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

Approve _____