

**Altamaha Spinymussel  
(*Elliptio spinosa*)**

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



*Photo Credit: Jason Wisniewski*

**U.S. Fish and Wildlife Service  
Southeast Region  
Georgia Ecological Services Field Office  
Athens, Georgia**

**March 2024**

## 5-YEAR STATUS REVIEW

### Altamaha Spiny mussel (*Elliptio spinosa*)

#### GENERAL INFORMATION

**Current Classification:** Endangered

**Lead Field Office:** Georgia Ecological Services Field Office, 706-613-9493

**Review Author:** Martha Zapata, Georgia Ecological Services Field Office, 706-535-2118

**Reviewers:**

**Lead Regional Office:** Southeast Region, Carrie Straight, 404-679-7226

**Date of original listing:** November 10, 2011 (76 FR 62928; October 11, 2011)

**Critical Habitat rule:** November 10, 2011 (76 FR 62928; October 11, 2011).

**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 Altamaha spiny mussel's biology, habitat, and threats to inform this status review.

Information summarized in this review includes information from the final listing rule, published and unpublished reports, field observations, and personal communications from recognized experts in the field along with information from a Species Status Assessment Report (Service 2021) that was developed by the Service and species experts. The Species Status Assessment is a peer-reviewed document that represents our evaluation of the best available scientific information regarding the biology, life history, and condition of the species. We published an announcement in the Federal Register requesting information on this species on May 11, 2023 (88 FR 30324), and a 60-day comment period was opened. No comments were received during this timeframe. This review was completed by the U.S. Fish and Wildlife Service, Georgia Ecological Services Field Office, Athens, Georgia. All literature and documents used for this review are on file at the Field Office. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the Altamaha spiny mussel.

**FR Notice citation announcing the species is under active review:** May 11, 2023 (88 FR 30324)

**Species' Recovery Priority Number at start of 5-year review (48 FR43098):** 5. Altamaha spiny mussel is a species with a high degree of threat and a low recovery potential.

**Review History:** A previous 5-year review recommending no change in status was published on July 15, 2019 (Service 2019).

## REVIEW ANALYSIS

### Listed Entity

**Taxonomy and Nomenclature:** We are not aware of any changes to the taxonomy of this entity, and it is still considered valid by the Service.

**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 definition limits listing of a DPS to only vertebrate species. Because the species under review is not a vertebrate, the DPS policy does not apply.

### Recovery Criteria

#### **Recovery Plan:**

Recovery Plan for the Altamaha Spiny mussel (*Elliptio spinosa*), December 19, 2023

Recovery plans are not regulatory documents but are 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 criteria for full recovery and delisting of the Altamaha spiny mussel are:

**Criterion 1 (Redundancy and Resiliency):** Through protection and augmentation of extant populations, successful establishment of reintroduced populations, and/or the discovery of additional populations, at least four populations exist: three high-resiliency populations persist in separate watersheds of the Altamaha basin and one additional moderate-resiliency population within its historical distribution.

- Resiliency is assessed based on the condition of two population needs: species presence and recruitment, and three habitat needs: water quality, water quantity, and host fish community (Service 2021, p. 34). Levels of resiliency are further defined in section 4.2.6 of the Species Status Assessment (Service 2021, p. 58).
- Populations are shown to be persistent and reproducing or increasing through annual or biannual monitoring over at least a 10-year period.
- If these include the establishment of reintroduced populations, monitoring and modeling of species viability show stable or increasing occupancy of suitable habitat over at least a 10-year period without additional population augmentation.

**Criterion 2 (Resiliency):** Each population in delisting criterion 1 exhibits evidence of recruitment, continued persistence, and positive or stable population trends through annual or

biannual monitoring for at least 10 years. In addition, unaided recruitment equals or exceeds mortality over a projected 42-year span.

- Longevity of Altamaha spiny mussels is unknown but *Elliptio* spp. maximum age is known to range from 14 to 57 years (Haag and Rypel 2011); therefore, 42 years is the expected minimum time to complete 3 generations.

**Criterion 3 (Resiliency and Representation):** Each population in delisting criterion 1 is supported by adequate flows, water quality, instream habitat, habitat connectivity, and host fish communities are maintained at levels that meet life history requirements.

- Adequate stream flows and water quality (*e.g.*, thermal tolerances) needed to support the Altamaha spiny mussel and its host fishes are now defined by research. Long-term management is ensured through state and local management plans and regulations.
- Habitats for Altamaha spiny mussel and host fish communities are adequately connected as measured via gene flow among Altamaha spiny mussel populations.
- When this requires active restoration of degraded habitat patches, measurable improvement to high-quality habitat (as defined by the primary constituents of Critical Habitat or subsequent research) for the Altamaha spiny mussel is accomplished and larval recruitment is occurring.

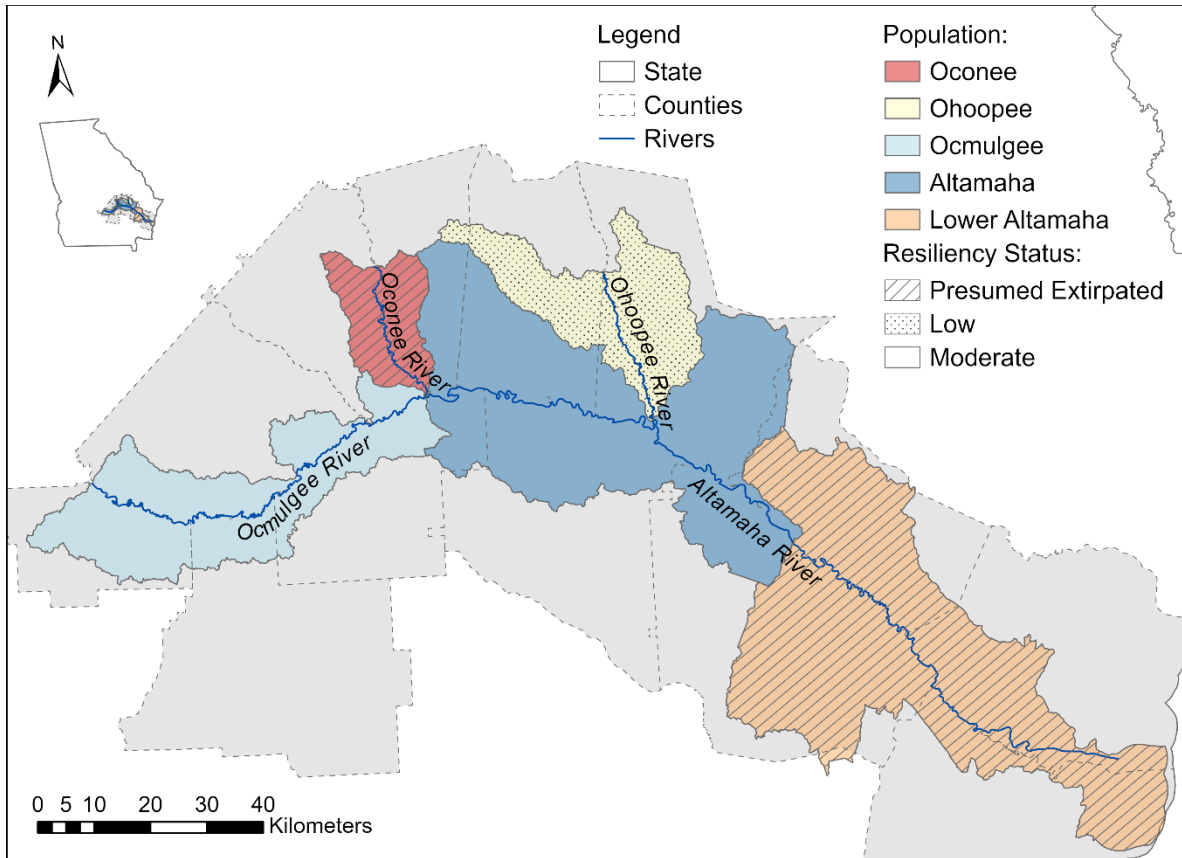
The Service believes these criteria are appropriate and relevant; however, no criteria have currently been met.

**Biology and Habitat Summary**

The Species Status Assessment (Service 2021) identifies four historical population units of the Altamaha spiny mussel: Oconee, Ochopee, Ocmulgee/Altamaha, and Lower Altamaha. Two populations (Oconee and Lower Altamaha) are presumed extirpated, and the other two (Ochopee and Ocmulgee/Altamaha) have rapidly declined, with densities so low that surveys since 2011 have failed to detect individuals (Table 1). Current population status, distribution, and recruitment remain unconfirmed. Because of the species’ rarity on the landscape additional population details are unknown.

**Table 1.** Status summary of population units of the Altamaha spiny mussel (*Elliptio spinosa*).

| <b>Population</b>               | <b>Last Observation</b>       | <b>Current Resiliency Status</b> |
|---------------------------------|-------------------------------|----------------------------------|
| <b>Oconee River</b>             | Historical; 1964; (60 years)  | Presumed Extirpated              |
| <b>Ochopee River</b>            | 2005 (19 years)               | Low                              |
| <b>Ocmulgee/Altamaha Rivers</b> | 2011 (13 years)               | Moderate                         |
| <b>Lower Altamaha River</b>     | Historical; 1990s (25+ years) | Presumed Extirpated              |



**Figure 1.** Current range and resiliency of the Altamaha spiny mussel populations.

The Service is 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 information provided in the Species Status Assessment remains valid (Service 2021).

### **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. The present or threatened destruction, modification, or curtailment of its habitat or range**

The Ocmulgee, Oconee, and Ohoopsee Rivers drain the Piedmont region, carrying legacy sediments from historical agricultural practices downstream to the Altamaha River (Jackson *et al.* 2005). Nonpoint sources like mining, agriculture, and urban development also contribute to excessive nutrient and sediment loads (Lasier *et al.* 2004; Schaefer and Alber 2007; Takagi *et al.* 2017). Increases in suspended solids could impact mussels by decreasing food availability, physically interfering with filter feeding and respiration, and impeding the mussel–host

relationship (Goldsmith *et al.* 2021). Agricultural runoff and industrial/municipal effluents were identified as potential contaminants of concern at listing. While heavy metal concentrations in water and sediment from the Altamaha River seemingly do not threaten mussels (Shoults-Wilson *et al.* 2010), contaminant and nutrient toxicity trials have not been conducted for Altamaha spiny mussel.

Past and future drought conditions pose another risk to the Altamaha spiny mussel's habitat. A natural flow regime with periodic flooding is critical in maintaining the exchange of nutrients with the floodplain, providing spawning habitat for potential host species, and maintaining sand bar habitats. Drought conditions may interfere with these processes. In 2007, 2011, and 2012, drought conditions created record low flows in the Altamaha River. Despite these historic low flows, mussels appeared to persist throughout most of the Lower Altamaha River Basin.

Freshwater mussels, like the Altamaha spiny mussel, face heightened vulnerability to droughts due to their sedentary nature and limited ability to seek refuge during drought events. As thermoconformers, changes in water temperature influenced by climate shifts can alter mussel assemblage structure (Galbraith *et al.* 2010). Direct impacts of drought, such as increased surface water temperature and decreased dissolved oxygen, likely had adverse effects on mussel populations during Georgia's droughts in 1998-2002, 2006-2009, and 2011-2012; this threat is expected to continue (see Service 2021 and references therein). We discuss the anticipated increase of extreme weather events like drought in Factor E.

Furthermore, escalating human demand for water in the Altamaha Basin, especially for power, irrigation, and consumption, strains local water supplies (Golladay *et al.* 2004). Withdrawals for power generation, industry, and agriculture can significantly impact flow rates (Marella and Fanning 1996), potentially stranding and causing desiccation-related mortality in mussels. As development increases in the Altamaha basin, water withdrawals are anticipated to rise, exacerbating the situation.

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

The Altamaha spiny mussel is not commercially harvested, but any illegal collecting poses a threat for the species, and it may be specifically sought out as its rarity becomes known. A Federal research permit and State permit are required for collection, with conditional measures to minimize potential impacts developed in consultation with the Service and Georgia Department of Natural Resources. Currently, there's no indication that overutilization for various purposes poses a significant threat to the species.

### **Factor C. Disease or predation**

Diseases affecting the Altamaha spiny mussel remain poorly studied, and therefore we currently have no information that disease is currently a threat to the species. Although there's no evidence of native predators posing a significant threat, the introduction of the predatory fish-eating flathead catfish (*Pylodictis olivaris*) into the Altamaha Basin raises concerns about potential threats to the unknown host fish of the Altamaha spiny mussel.

#### **Factor D. The inadequacy of existing regulatory mechanisms**

Nonpoint source pollution that may negatively affect mussel habitats originates from agricultural runoff, urbanization, and mining and timber operations. Best Management Practices (BMPs) can safeguard aquatic ecosystems, but poor compliance monitoring and enforcement may compromise their effectiveness. Land use practices that can cause nonpoint source pollution pose a challenge as they may import sediment, nutrients, and contaminants into the Altamaha River. Nonpoint source pollution regulation is complex due to the absence of specific discharge permits. Under the Clean Water Act, as amended (33 U.S.C. 1251 *et seq.*), point source dischargers must obtain permits based on water quality standards derived from laboratory toxicity testing. Limited toxicity data for freshwater mussels raises uncertainty about the protectiveness of Clean Water Act water quality standards. Currently, regulatory mechanisms are not sufficient to fully protect the species from threats.

#### **Factor E. Other natural or manmade factors affecting its continued existence**

**Climate Change:** Climate change heightens the Altamaha spiny mussel's vulnerability to extreme weather and may alter habitat suitability within its historical range. Emission scenarios predict a 1.5°C temperature increase in the first half of the 2030s and likely 2.0°C increase by the end of the 21<sup>st</sup> century, with intensified heatwaves and precipitation events (IPCC 2023). Higher temperatures are projected to increase and will also likely increase chances of extreme drought (Frankson *et al.* 2022). Future precipitation trends for the southeast are uncertain, but projections suggest reduced annual precipitation and less frequent but stronger tropical storms (Carter *et al.* 2014). The southeastern United States will experience warmer temperatures, altered runoff, and increased drought frequency due to climate change, affecting water temperatures, flow, dissolved oxygen levels, and raising temperatures in stream systems (Poff *et al.* 2002). There is a natural inverse relationship between water temperature and dissolved oxygen, with increasing ambient temperature, our waters will also see increases in water temperature and a reduction in dissolved oxygen. This climate change changes to our aquatic systems will likely result in increased stress in the mussel and any host fish species and may potentially increase mortality of individuals.

**Unknown Host:** The unidentified host fish for the Altamaha spiny mussel hinders the assessment of its status and potential threats. This knowledge gap constrains our understanding of both the present and future condition of the Altamaha spiny mussel.

**Small Population Size:** Factors like low effective population size, genetic isolation, limited fecundity, recruitment, and juvenile survival are likely impacting the Altamaha spiny mussel's ability to maintain or recover populations. Recent (pre-2011) surveys revealed very small, fragmented occurrences below historic levels. For broadcast spawners like the Altamaha spiny mussel, reduced numbers of mature individuals decrease the chances of successful reproduction. Small, fragmented populations face genetic diversity loss due to isolation, increasing the risk of genetic bottlenecks and inbreeding depression. This can reduce reproductive output, survivorship, and the species' ability to adapt to future environmental changes.

**Introduced Species:** The introduction of non-native species like the flathead catfish and Asian clam (*Corbicula fluminea*) to the Altamaha Basin could harm native species, including Altamaha

spiny mussel and its host(s). Flathead catfish, now the dominant fish-eating predator, may have led to declines in potential host fish. Asian clams compete with native mussels for resources and may disturb and displace young mussels, affecting their survival and growth (Strayer 1999; Yeager *et al.* 1999). The impact on the Altamaha spiny mussel remains unclear despite the presence of Asian clams for over 25 years in the basin (Gardner *et al.* 1976).

## **Synthesis**

The Altamaha spiny mussel is an endangered freshwater mussel endemic to the Altamaha River and its major tributaries in southeastern Georgia. Two of the four historic populations are presumed extirpated, and the other two have rapidly declined, with densities so low that surveys have failed to detect individuals in more than a decade. Sediments from historic land use practices, riverine and watershed land use changes, and current point and non-point pollution negatively impact the Altamaha River and its tributaries. Climate change, droughts, water demand, and non-native species heighten the vulnerability of the species. Low genetic diversity, limited recruitment, and gaps in our knowledge of its life history (*e.g.*, unknown host species) further hinder the species' potential for recovery and limit the species' viability. Due to limited numbers of known individuals, the species' increased rarity on the landscape and the continued and future threats, the species continues to meet the definition of an endangered species.

## **RECOMMENDED FUTURE ACTIVITIES**

In the upcoming years, priority activities include:

- Conduct comprehensive range-wide surveys to assess the current population status of the Altamaha spiny mussel.
- Captive Propagation / Reintroduction / Augmentation Activities
  - Assess population status, size, genetic structure, and distribution.
  - Assess host species.
  - Assess use of in-vitro metamorphosis.
  - Identify and/or restore suitable sites for reintroduction.
  - Develop propagation plan.

Detailed discussions on recovery actions and criteria are outlined in the Altamaha Spiny mussel Recovery Plan (Service 2023a) and the Recovery Implementation Strategy (Service 2023b).

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## RESULTS / SIGNATURES

### U.S. Fish and Wildlife Service Status Review of Altamaha Spiny mussel

#### **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

#### **FIELD OFFICE APPROVAL:**

**Field Supervisor, Georgia Ecological Services Field Office, Fish and Wildlife Service**

Approve \_\_\_\_\_