Anthony's Riversnail
(*Athearnia anthonyi*)

5-Year Status Review:
Summary and Evaluation

Photo credit: Alabama Department of Conservation and Natural Resources, Alabama Aquatic Biodiversity Center

U.S. Fish and Wildlife Service
Southeast Region
Tennessee Ecological Services Field Office
Cookeville, Tennessee

June 2023

5-YEAR STATUS REVIEW

Anthony's Riversnail (*Athearnia anthonyi*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Tennessee Ecological Services Field Office, Santiago Martín, (931) 254-9617

Reviewers:

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

Cooperating Field Office(s): Alabama Ecological Services Field Office, Erin Padgett, (251) 441-5842

Date of original listing: May 16, 1994 (59 FR 17994; April 15, 1994)

Experimental population designation:

Establishment of Nonessential Experimental Population Status for 15 Freshwater Mussels, 1 Freshwater Snail, and 5 Fishes in the Lower French Broad River and in the Lower Holston River, Tennessee: October 15, 2007 (72 FR 52433; September 13, 2007).

Establishment of Nonessential Experimental Population Status for 16 Freshwater Mussels and 1 Freshwater Snail (Anthony's Riversnail) in the Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL; Correction: August 21, 2001 (66 FR 43808; August 21, 2001).

Establishment of Nonessential Experimental Population Status for 15 Freshwater Mussels and 1 Freshwater Snail (Anthony's Riversnail) in the Free-Flowing Reach of the Tennessee River below the Wilson Dam, Colbert and Lauderdale Counties, AL: July 16, 2001 (66 FR 32250; June 14, 2001).

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 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 biology, habitat, and threats of the Anthony's riversnail to inform this status review.

We announced initiation of this review in the Federal Register on May 13, 2022 (87 FR 29364) with a 60-day comment period. We received one comment from The National Council for Air and Stream Improvement (NCASI) that provided information regarding the use and effectiveness of forestry best management practices and their importance in protecting aquatic species and stream habitats in the United States. We incorporated the

information provided by NCASI in the threats summary. The primary sources of information used in this analysis were the 1994 final listing rule (59 FR 17994), the 1997 recovery plan, peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts.

This review was completed by the Service, Tennessee Ecological Services Field Office (TNFO), Cookeville, Tennessee. All literature and documents used for this review are on file at the TNFO. A completed draft of this 5-year review was sent to the Cooperating Field Office above for review and comment. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the Anthony's riversnail. We have not received significant new information, interpreted previously reviewed information in a new, significant light since the last review of the species, and the level of public interest is low and non-controversial; therefore, no peer review was conducted.

FR Notice citation announcing the species is under active review:

May 13, 2022 (87 FR 29364)

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

The Anthony's riversnail has a recovery priority number of 5, indicating a high degree of threat, a low recovery potential, and species level taxonomy.

Review History:

We have published two 5-year reviews since the listing of the Anthony's riversnail, one on March 11, 2011, and the other on March 8, 2018. These 5-year reviews recommended "no change" in status (Service 2011, 2018).

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. The nomenclature is consistent with and follows that listed in the Integrated Taxonomic Information System (2023) and by the Freshwater Mollusk Conservation Society (Johnson et al. 2013; FMCS 2021).

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 a not a vertebrate, the DPS policy does not apply.

Recovery Criteria

Recovery Plan or Outline:

Final Recovery Plan for Anthony's Riversnail (*Athearnia anthonyi*), August 13, 1997.

Recovery plans are not regulatory documents, and their purpose is 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).

Anthony's riversnail will be considered for reclassification to threatened status when the likelihood of the species becoming extinct in the foreseeable future has been eliminated by achievement of the following criteria:

Criterion 1. *Through protection of both existing populations and successful reestablishment or discovery of additional populations, a total of four distinct viable populations*[1] *exist within the species' historic range.*

Criterion 2. *Each of the four populations must have at least two year classes present and show evidence of successful reproduction (with at least one juvenile age class present).*

Criterion 3. *All four populations and their habitats are protected from present and foreseeable threats.*

Criterion 4. *All four populations remain stable or increase over a period of at least 10 years.*

Anthony's riversnail will be considered for removal from the Act's protection when the likelihood of the species becoming threatened in the foreseeable future has been eliminated by the achievement of the following criteria:

Criterion 1. *Through protection of both existing populations and successful establishment or discovery of additional populations, a total of six distinct viable populations*[1] *exist within the species' historic range.*

Criterion 2. *Each of the six populations must have at least two year classes present and show evidence of reproduction, with at least one juvenile age class present.*

Criterion 3. *All six populations and their habitats are protected from present and foreseeable threats.*

[1] Viable Population – A naturally reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural environmental changes. The number of individuals and the amount and quality of habitat required to meet this criterion will be determined for the species as one of the recovery tasks.

Criterion 4. *All six populations remain stable or increase over a period of at least 10 years.*

We believe these criteria are appropriate and relevant. At this time, none of the criteria above have been met.

Biology and Habitat Summary

Anthony's riversnail is endemic to the Tennessee River system where it inhabits medium to large rivers with cobble or boulder substrates. The species was historically known from the lower French Broad, Holston, and Clinch Rivers in east Tennessee downstream to Muscle Shoals in Alabama, including some Tennessee River tributaries (Service 1997). Currently, Anthony's riversnail occupies four streams in Tennessee and Alabama (Table 1). The best available genetic information indicates that these four streams contain one of three populations: Tennessee River, Sequatchie River, and Limestone Creek (Minton and Savarese 2005; Service 2018). Staff from the Alabama Department of Conservation and Natural Resources, Alabama Aquatic Biodiversity Center are planning to reintroduce a population within the species' historical range in the Elk River (P. Johnson 2023, pers. comm.).

Table 1: Status assessment of streams with extant and historical records for Anthony's riversnail.

State	Stream	County	Approximate Extent	Last Observation
Tennessee	Little Sequatchie River	Marion	2 km	2007
	Sequatchie River	Marion	12.5 km	2022
	Tennessee River	Marion	12 km	1994
Alabama	Tennessee River	Jackson	13 km	2015
	Limestone Creek	Limestone	14.5 km	2022

The species' lifespan is at least two years, and adults have at least two breeding seasons per year; however, more information is needed to improve the maximum age estimate (Garner and Haggerty 2010).

Tennessee River Population

This population occupies the Tennessee River mainstem from the Nickajack Dam tailwaters, Marion County, Tennessee, downstream to approximately Tennessee River mile 409, Jackson County, Alabama (Service 2018; Figure 1). Surveys in the mid- to late-1990s reported densities of one individual per square meter (m^2) to one individual per 100 m^2 as well as evidence of recruitment (Garner 1994; ERM 1996). More recently, Garner et al. (2022) noted the observation of 19 individuals, including a juvenile, at three of five dive sites surveyed in 2015.

No additional surveys have been completed for this population since the last 5-year review

Sequatchie River Population

This population occupies the Little Sequatchie River and Sequatchie River from the Tennessee State Route 28 bridge crossing downstream to the confluence with the Tennessee River, Marion County, Tennessee (Service 2018; Figure 1). The Tennessee Valley Authority has a long-term monitoring site near Nickletown, Tennessee, where the species has been observed during benthic sampling. During the last three sampling events (2010, 2012, and 2018) species has been reported as common (10-100 individuals; J. Simmons 2021, pers. comm.).

In 2022, a multi-agency group conducted a comprehensive sampling effort of the Sequatchie River watershed with a focus on mussels. Of the six sites sampled within the known range, Anthony's riversnail was reported present at two locations with six live individuals observed at one site (J. Wisniewski 2022, pers. comm.). No other information about the status of this population has been reported since the last 5-year review.

Limestone Creek Population

This population occupies Limestone Creek from the Martin Branch confluence downstream to the upper limit of the Wheeler Reservoir embayment in Limestone County, Alabama. This population is the most robust of the three remaining. The population was assessed in 1996 and was found to occupy approximately 14.5 kilometers with mean densities of 83.9 individuals per m^2. (Garner and Haggerty 2010).

A reassessment of the sites monitored in 1996 was initiated in 2022 and will conclude in 2023. Preliminary results show that Anthony's riversnail densities varied across sites and time, with the highest densities observed in July across sites. Mean densities reported for five sites combined are 55.3 ± 8.5 (SE, standard error) individuals per m^2 in May, 140.4 ± 24.4 (SE) individuals per m^2 in July, and 88.7 ± 12.0 (SE) individuals per m^2 in Augusts (Garner et al. 2023).

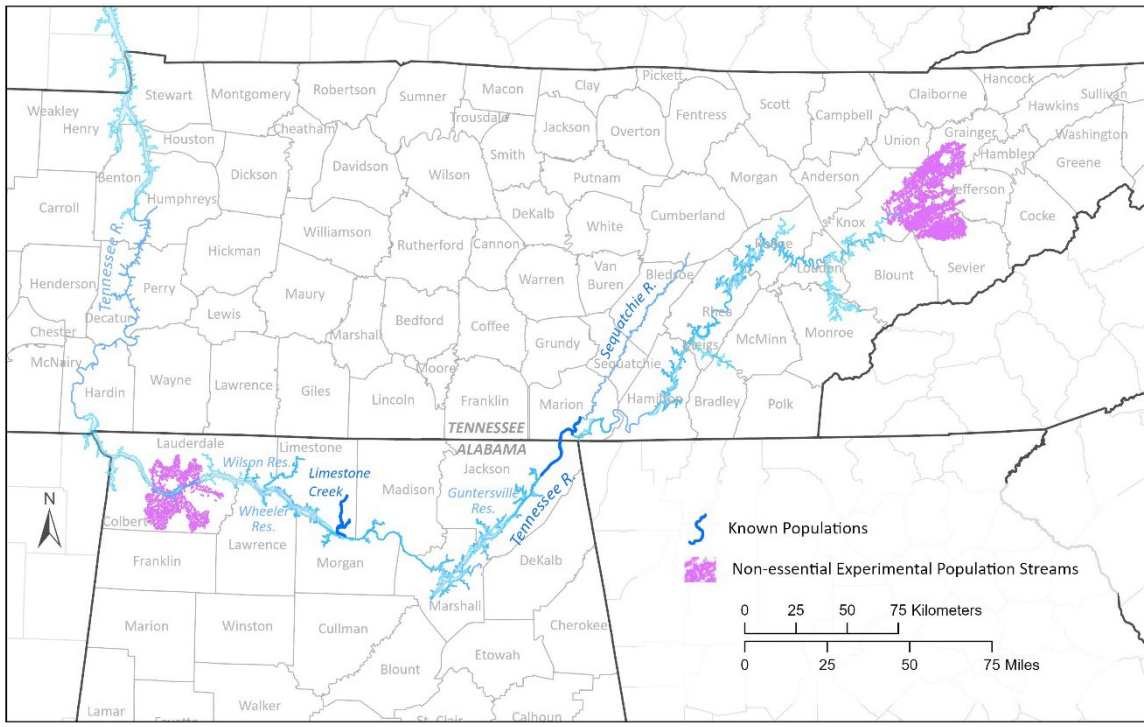

Figure 1: Anthony's riversnail range map showing current occupied streams (dark blue lines) and designated non-experimental population streams (purple lines).

Non-Essential Experimental Populations

We have designated two Non-Essential Experimental Populations (NEPs) for this species in Alabama and Tennessee to facilitate the species' recovery (Service 2001, 2007; Figure 1). From 2003 to 2008, the Alabama Department of Conservation and Natural Resources translocated 4,000 individuals from the Limestone Creek population to the Alabama NEP below Wilson Dam. However, annual monitoring of this reintroduction effort ceased in 2012 due to lack of success in establishing a population, possibly due to some erosion events documented in the vicinity of this effort during this time frame (Garner et al. 2022).

No additional reintroduction or monitoring efforts have been attempted in the Alabama or Tennessee NEPs since the last 5-year review.

Threats (Five-Factor Analysis) Summary

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

The best available information continues to indicate that the loss of riverine habitat due to the Tennessee River impoundment and deterioration of water quality continue to be the primary drivers negatively affecting Anthony's riversnail habitat (Service 2018). In addition, urban growth and development continues to pose a threat to the Anthony's riversnail. Expansion from the City of Huntsville, Alabama, and its annexation of lands in Limestone County has contributed an increase in residential and industrial development and associated

infrastructure near Limestone Creek. An analysis of land use change from 2001 to 2019 indicates that the area of developed land[2] of low, medium, and high intensity grew by 25.92%, 106.20%, and 79.97% respectively. As of 2019, 10.69% of Limestone County has been developed (MRLC 2023).

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

We did not find that overutilization for commercial, recreational, scientific, or educational purposes threatened the Anthony's riversnail in the final listing rule for this species (Service 1994). No new information has emerged that changes our understanding of this factor.

Factor C - Disease or predation:

We did not find that disease or predation threatened the Anthony's riversnail in the final listing rule for this species (Service 1994). No new information has emerged that changes our understanding of this factor.

Factor D - Inadequacy of existing regulatory mechanisms:

Protection of Anthony's riversnail through regulatory mechanisms have not changed since the last 5-year review (Service 2018). Existing regulatory mechanisms (e.g., Clean Water Act) have provided some improvements in water quality and habitat conditions but 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; however, the proper implementation of best management practices can be effective in protecting water quality and instream habitats, which can moderate threat in many instances as is the case with forestry (Cristan et al. 2016; Warrington et al. 2017; Schilling et al. 2021). The best available information does not indicate that the magnitude or imminence of this threat is likely to be appreciably reduced in the foreseeable future.

Factor E - Other natural or manmade factors affecting its continued existence:

The best available information continues to indicate that the small, fragmented range that the Anthony's riversnail occupies increases the species vulnerability to localized extinction due random events, such as toxic chemical spills, as well as loss of genetic diversity and adaptive potential through genetic drift (Service 2018).

We also consider climate change (IPCC 2022) to be an emerging threat that may significantly affect the long-term viability of remaining Anthony's riversnail populations. There is uncertainty about the specific effects of climate change (and their magnitude) on the Anthony's riversnail; however, climate change is almost certain to affect aquatic habitats through changes in water availability, timing, magnitude, and duration of rainfall events. Climate change has the potential to increase the vulnerability of the Anthony's riversnail to random catastrophic events, primarily through more intense or frequent droughts. Droughts can potentially have negative impacts on water quality (e.g., lower dissolved oxygen and higher temperature) and waste dissemination of point source discharges. Droughts may also reduce the amount of habitat available to the species by dewatering habitat and may also lead

[2] Definitions for developed land of low, medium, and high intensity can be found here: National Land Cover Database Class Legend and Description | Multi-Resolution Land Characteristics (MRLC) Consortium

to direct mortality by stranding aquatic snails. Drought may also isolate sections of stream into stagnant pools.

Synthesis

Anthony's riversnail is currently extant in only three populations in the Tennessee River system: the Tennessee River, Sequatchie River, and Limestone Creek. The species prefers medium to large river habitats with cobble or boulder substrates in the vicinity of riffles with strong current. Population demographics are only available for the Limestone Creek population, which appeared to be viable in 2022. Similar information is lacking for the Tennessee and Sequatchie River populations.

Habitat and water quality degradation from both point and non-point sources remain the greatest threats to Anthony's riversnail range wide. The species also remains vulnerable to increased urbanization and potential stochastic events, such as toxic chemical spills, especially the Limestone Creek population. Climate change is an emerging threat that may be especially detrimental to the Anthony's riversnail, as species with fragmented distributions, and small population sizes are thought to be more vulnerable to the effects of climate change.

Due to its fragmented distribution in small, isolated populations, its continued exposure to multiple threats, our poor understanding of these threats, and the uncertainty about the viability of extant populations, we believe that the Anthony's riversnail continues to meet the definition of endangered (in danger of extinction throughout all or a significant portion of its range). The recovery priority number for this species should remain at 5, as the species has a high degree of threat and a low recovery potential.

RECOMMENDED FUTURE ACTIVITIES

Implement conservation actions recommended in the Recovery Plan for Anthony's Riversnail (Service 1997), the Tennessee Wildlife Action Plan (https://www.tn.gov/content/tn/twra/wildlife/action-plan.html), the Alabama Wildlife Action Plan (https://www.outdooralabama.com/research/state-wildlife-grants), or the National Strategy for the Conservation of Native Freshwater Mollusks (FMCS 2016).

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RESULTS / SIGNATURES

U.S. Fish and Wildlife Service
Status Review of Anthony's Riversnail (*Athearnia anthonyi*)

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*

_X_ No change needed

FIELD OFFICE APPROVAL:

Field Supervisor, Tennessee Ecological Services Field Office, U.S. Fish and Wildlife Service

Approve DANIEL ELBERT Digitally signed by DANIEL ELBERT Date: 2023.06.27 09:49:51 -05'00'