Anthony's riversnail
(Athearnia anthonyi)

5-Year Review:
Summary and Evaluation

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

5-YEAR REVIEW
Anthony's riversnail/*Athearnia anthonyi*

Please refer to our signature page on p. 16 to see our determination related to our second 5-year review for this snail which we initiated in 2017 (82 FR 29916). We found no new information since this 2011 5-year review and therefore reaffirm that no status change is needed.

I. GENERAL INFORMATION

A. Methodology used to complete the review:

On June 30, 2017, the Service published a notice in the Federal Register (82 FR 29916) announcing the 5-year review of Anthony's riversnail (*Athearnia anthonyi*) and requested new information concerning the biology and status of the species. A 60-day comment period was opened; however, no information on the species was received from the public during the comment period.

In conducting this 5-year review, we relied on available information pertaining to historic and current distribution, life history, and habitat of this species. Our sources include the final rule listing this species under the Endangered Species Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. In 2011, when the last 5-year review was conducted, comments received and suggestions from peer reviewers were evaluated and incorporated as appropriate (see Appendix A).

B. Reviewers

Lead Field Office – Cookeville, Tennessee, Ecological Services: Stephanie Chance, 931-525-4981

Cooperating Field Office – Daphne, Alabama, Ecological Services: Jeff Powell, 251-441-5181

Lead Region – Southeast: Kelly Bibb, 404-679-7132

C. Background

1. **FR Notice citation announcing initiation of this review:** June 30, 2017, 82 FR 29916.

2. **Species status:** Stable, 2010 Recovery Data Call. There are no current surveys or population status assessments for this species. The Limestone Creek population might be declining and biologists note an increase in urbanization in the watershed (Johnson 2017, pers. comm.).

3. **Recovery achieved:** 1 (0-25%) recovery objectives achieved

4. Listing history:

Original Listing
FR notice: 59 FR 17994
Date listed: April 15, 1994
Entity listed: Species
Classification: Endangered

5. Associated rulemakings:

September 13, 2007. 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. 72 FR 52433.

August 21, 2001. 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. 66 FR 43808.

June 14, 2001. 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. 66 FR 32250.

6. Review History:

Recovery Data Call: 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, and 2000
Recovery Plan: August 13, 1997

7. Species' Recovery Priority Number at start of review (48 FR 43098): 5 (degree of threat is high, potential for recovery is low, and the taxonomy is at the species level)

8. Recovery Plan:

Name of plan: Recovery Plan for Anthony's Riversnail (*Athearnia anthonyi*)
Date issued: August 13, 1997

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. Is the species under review listed as a DPS? No. The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population of a species of vertebrate wildlife. This definition

limits listing a DPS to only vertebrate species of fish or wildlife which interbreeds when mature. Because the species under review is an invertebrate, and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes. The recovery plan contains objective, measurable downlisting and delisting criteria.

2. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? Yes.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

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:

1) Through protection of existing populations and through the successful establishment of reintroduced populations or the discovery of additional populations, a total of four distinct viable populations exist. These four populations shall be distributed throughout a significant portion of the species' historic range.

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.

This criterion has not been met. The recovery plan (USFWS 1997) identifies two populations of Anthony's riversnail – one in the Tennessee River in Jackson County, Alabama, and Marion County, Tennessee, extending into the lower Sequatchie River, Marion County, Tennessee; and one in the lower reaches of Limestone Creek, Limestone County, Alabama. However, Minton and Savarese (2005) identified genetically unique haplotypes at all three locations supporting

three separate populations in the Tennessee River, Sequatchie River, and Limestone Creek. Minton and Savarese (2005) recommended that introductions of each haplotype into new areas within their current river system is preferred to avoid mixing of these unique entities and possible elimination of the current genetic diversity. If translocations are to occur, they suggest that the Limestone Creek population is a better option for augmenting the Sequatchie River population. Although there have not been any new populations discovered since the recovery plan was written, subsequent discussions will refer to the three separate populations.

The Sequatchie and Tennessee River populations have not been extensively monitored recently, but observations indicate that the species still occurs in these areas. In 1996-1997, Garner and Haggerty (2010) conducted quantitative monitoring of a 14.5 km reach of Limestone Creek. In a three month period, they found mean densities 83.9 per m^2 at four sites. Surveys a decade later suggest that there has not been a change in the snail's current range in Limestone Creek (Garner and Haggerty 2010). However, in 2017, biologists noted an increase in urbanization in the watershed and limited sampling indicates the Limestone Creek population might be declining and (Johnson 2017, pers. comm.). A larger survey effort is needed to determine the status of the snail in Limestone Creek.

From 2003 to 2008, 4,000 Anthony's riversnails were released into the NEP below Wilson Dam at Tennessee River mile 249 (72 FR 52433, Garner and Haggerty 2010). Reproduction of the reintroduced snails was recorded during the summer of 2008.

In the 2000s, two new localities for the species were discovered. In 2007, Anthony's riversnail was reportedly common adjacent to the State Route 28 bridge crossing of the Little Sequatchie River (Tennessee Department of Environment and Conservation, Division of Natural Areas 2010). This locality is assumed to belong to the Sequatchie River population. In 2009, Tennessee Valley Authority (TVA) biologists collected one live and one dead Anthony's riversnail in Guntersville Reservoir at TRM 409 in a ponar sample (Howard 2009, pers. comm.).

To summarize, Anthony's riversnail has three natural populations (Tennessee River, Sequatchie River, and Limestone Creek) throughout its historic range based on new information provided in Minton and Savarese (2005). It has been reintroduced into Wilson Dam tailwater on the Tennessee River and is showing signs of natural reproduction in the tailwater. However, the Limestone Creek population might be in decline.

2) At least two distinct, naturally reproduced year classes exist within each of the four populations. One of these year classes must have been produced within the 2 years prior to the time the species is reclassified from endangered to threatened.

This criterion has not been met. The Limestone Creek population has at least two distinct age classes (Garner and Haggerty 2010) and but viability is unknown (Johnson 2017, pers. comm.). The other populations of Anthony's riversnail have not been assessed, but observations of the Sequatchie River population show that it might be much smaller than the Limestone Creek population (Johnson 2009, pers. comm.). The Tennessee River population is thought to be extensive when compared to the Limestone Creek population, but contains lower densities of the snail (Alabama Natural Heritage Program 2010). A range-wide status assessment is needed to determine the viability of all populations (Limestone Creek, Tennessee, and Sequatchie rivers).

3) Biological and ecological studies have been completed and any required recovery measures developed and implemented from these studies are beginning to show signs of success, as evidenced by a significant increase in population density and/or an increase in the length of the river reach inhabited by each of the four populations.

This criterion has not been met. In 2009, the Alabama Aquatic Biodiversity Center (AABC) conducted trial culture efforts on the Anthony's riversnail (Johnson 2009, pers. comm.). These initial efforts suggest that the snail ovideposits early in the year, with egg laying likely beginning in March and continuing through June. In 2009, the AABC plans to continue trials to verify the method and seasonality of egg-laying (Johnson 2009, pers. comm.). Other studies concerning the biological and ecological requirements of the snail are still needed (see Section IV. Recommendations for Future Actions).

4) Where habitat has been degraded, noticeable improvements in water and/or substratum quality have occurred.

This criterion has not been met. Urbanization threatens the Limestone Creek population, and industry is being recruited to the area (Garner 2009, pers. comm.). The Sequatchie River population is vulnerable due to abandoned mining activities that can cause siltation and point or nonpoint source pollution (Johnson 2009, pers. comm.), and may be the most vulnerable of the three populations. The Tennessee Department of Environment and Conservation (TDEC) lists the Sequatchie River in their 303d list as impaired due to pasture grazing and atmospheric deposition of mercury (TDEC 2017). The Tennessee River population is found below Nickajack Dam, and is dependent upon operations of the dam. The TVA operates Nickajack which is west of Chattanooga as a run-of-river project for hydropower and navigation. High shear stress, peak flows, and substrate movement limit mussel communities, reduce abundance, and can cause animals to be dislodged downstream (Layzer and Madison 1995, Gangloff and Feminella 2006). High discharge events potentially reduce abundance of Anthony's riversnail in the Tennessee River. In addition, there is an increasing threat from industry and urbanization surrounding this population.

5) Each of these four populations and their habitats are protected from any present and foreseeable threats that would jeopardize their continued existence.

This criterion has not been met. See criterion four above for more detail.

6) All four populations remain stable or increase over a period of at least 10 years.

This criterion has not been met. Population assessments are needed for the three populations (Tennessee River, Sequatchie River, and Limestone Creek). As identified by the Cumberlandian Region Mollusk Restoration Committee (CRMRC), priority actions for the species include: continue reintroductions into Wilson Dam tailwater, complete updated survey efforts in the Sequatchie River, and determine if translocations into the Nolichucky River are warranted (CRMRC 2009). The CRMRC (2009) lists the Wilson Dam tailwater NEP, the lower French Broad and Holston rivers NEP, and the Nolichucky River as potential reintroduction streams. The habitat at these potential reintroduction sites should be reevaluated prior to release of animals, and "trial" releases would help determine how successful larger reintroduction efforts might be (Johnson 2009, pers. comm.).

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

1) Through protection of existing populations and through the successful establishment of reintroduced populations or the discovery of additional populations, a total of six distinct viable populations exist. These populations shall be distributed throughout a significant portion of the species' historic range.

2) Two distinct, naturally reproduced year classes exist within each of the six populations. One of these year classes must have been produced within the 2 years prior to the recovery date.

3) Studies of the snail's biological and ecological studies have been completed, and recovery measures developed and implemented from these studies have proven successful, as evidenced by a significant increase in population density and/or an increase in the length of the river reach inhabited by each of these six populations.

4) Where habitat has been degraded, noticeable improvements in water and/or substratum quality have occurred.

5) Each of these six populations and their habitats are protected from any present and foreseeable threats that would jeopardize their continued existence.

6) All six populations remain stable or increase over a period of at least 10 years.

The de-listing criteria have not been met. See explanations above for downlisting criteria.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features, or demographic trends:

The only population and demographic trend information available for Anthony's riversnail concerns the Limestone Creek population, this type of information is completely lacking for the Sequatchie and Tennessee River populations. In 1996-1997, Garner and Haggerty (2010) conducted quantitative monitoring of a 14.5 km reach of Limestone Creek. In a three month period, they found mean densities 83.9 per m^2 at four sites. Surveys a decade later suggest that there has not been a change in the snail's current range in Limestone Creek. The size frequency distribution of Anthony's riversnail in Limestone Creek indicates that there were at least two age cohorts present, and that a potential recruitment event occurred between May and July (Garner and Haggerty 2010). Garner and Haggerty were unable to determine the life span of Anthony's riversnail, but suggest that the species may have at least two breeding seasons (2010).

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Dillon and Ahlstedt (1997) used allozyme electrophoresis to compare Anthony's riversnail from the Sequatchie River to a co-occurring population of onyx rocksnail, *Leptoxis praerosa*, (a closely related snail that is similar in appearance to Anthony's riversnail) and to a population of onyx rocksnail occurring in the Duck River. Their study concluded that Anthony's riversnail is a valid species. The level of intrapopulation variation found in Anthony's riversnail was low when compared to most other organisms, but comparable to that found in other pleruocerid snails (Dillon and Ahlstedt 1997). In addition, (Dillon and Ahlstedt 1997) were unable to detect evidence of inbreeding or a population bottleneck.

The recovery plan (USFWS 1997) identifies two populations of Anthony's riversnail – one in the Tennessee River in Jackson County, Alabama, and Marion County, Tennessee, extending into the lower Sequatchie River, Marion County,

Tennessee; and one in the lower reaches of Limestone Creek, Limestone County, Alabama. However, Minton and Savarese (2005) identified genetically unique haplotypes at all three locations supporting three separate populations in the Tennessee River, Sequatchie River, and Limestone Creek. Minton and Savarese (2005) further support that Anthony's riversnail is a distinct species from onyx rocksnail.

c.Taxonomic classification or changes in nomenclature:

Although both Dillon and Ahlstedt (1997) and Minton and Savarese (2005) recognize Anthony's riversnail as distinct species from onyx rocksnail, the former authors still recognize the taxon as a subspecies, *Leptoxis crassa anthonyi*, instead of giving it the full species status as *Athearnia anthonyi*. Minton and Savarese (2005) mention the boulder snail, *Leptoxis crassa crassa*, as another closely related taxon. There is current disagreement regarding whether or not *Athearnia* is a genus or subgenus of *Leptoxis*. For a description of the unresolved systematic relationship of these taxa see Turgeon et al. (1998).

The current taxonomy of Anthony's riversnail, as recognized in Turgeon et al. (1998) and the Integrated Taxonomic Information System (ITIS) (2010) is *Leptoxis crassa anthonyi* (Redfield 1854). However, Anthony's riversnail is still widely recognized as *Athearnia anthonyi* (Dillon and Ahlstedt 1997, Mirarchi et al. 2004b, CRMRC 2009, and NatureServe 2009). The Service continues to recognize this snail as *Athearnia anthonyi* and will work with partners and continue to use *Athearnia anthonyi* until the systematic relationship is resolved.

d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

There are no changes in the historic range of Anthony's riversnail since the Recovery Plan was written in 1997. Two recent observations represent new localities for the species. In 2007, Anthony's riversnail was reportedly common adjacent to the State Route 28 bridge crossing of the Little Sequatchie River (TDEC 2010). In 2009, TVA biologists collected one live and one dead Anthony's riversnail in Guntersville Reservoir at TRM 409 in a ponar sample (Howard 2009, pers. comm.).

e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

No new information exists on habitat conditions for the riversnail. The species prefers medium to large river habitats with cobble/boulder substrates in the vicinity of riffles with strong current (USFWS 1997).

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

a. Present or threatened destruction, modification or curtailment of its habitat or range:

As indicated in the Recovery Plan (USFWS 1997), impoundments, mining, toxic chemical spills, siltation, agriculture, timber harvest, runoff and discharge of organic and inorganic pollutants, channelization, dredging, and streambank erosion remain threats to the Anthony's riversnail. In addition, the Limestone Creek population is threatened by increased urbanization (Garner and Haggerty 2010). Overall, the greatest threat to the riversnail is habitat modification and destruction due to point and non-point source pollution.

Habitat destruction resulting from a variety of human-induced impacts such as siltation, disturbance of riparian corridors, and changes in channel morphology continues to impact the Anthony's riversnail. The most significant of these impacts is siltation caused by excessive releases of sediment from activities such as agriculture, resource extraction (e.g., coal mining, silviculture), road construction, and urban development (Waters 1995). Activities that contribute sediment discharges into a stream system change the erosion or sedimentation pattern, which can lead to the destruction of riparian vegetation, bank collapse, excessive instream sediment deposition, and increased water turbidity and temperatures (Waters 1995). The effects of these types of threats will likely increase as human populations grow in the Tennessee River watershed in response to human demands for water, housing, transportation, and places of employment.

Non-point source pollution from land surface runoff can originate from virtually any land use activity (such as land development and agricultural activities) and may be correlated with impervious surfaces and storm water runoff from urban areas. Pollutants may also originate from spills (for further information see Factor E). Pollutants entering the Sequatchie and Tennessee rivers and Limestone Creek may include sediments, fertilizers, herbicides, pesticides, animal wastes, pharmaceuticals, septic tank and gray water leakage, and petroleum products. These pollutants tend to increase concentrations of nutrients and toxins in the water and alter the chemistry of affected streams such that the habitat and food sources for species like the Anthony's riversnail are negatively impacted.

b. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization is not known to be a factor in the decline of this species.

c. Disease or predation:

The Recovery Plan states that disease, parasites, and predation might pose a threat

to Anthony's riversnail. The plan states that diseases have not been identified, but lists several potential parasites and predators. The effects of predation on the snail have not been studied, but predation is not thought to be a major factor in the decline of this species. Dillon and Ahlstedt (1997) did not find evidence of parasitism in 37 Anthony's riversnails from the Sequatchie River. Although it had been hypothesized that the large sizes attained by Anthony's riversnail were due to parasite induced gigantism, Dillon and Ahlstedt (1997) found no evidence to support this.

d. Inadequacy of existing regulatory mechanisms:

The Anthony's riversnail and its habitats are afforded limited protection from water quality degradation under the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.) and the Tennessee Water Quality Control Act of 1977. These laws focus on point-source discharges, and many water quality problems are the result of non-point source discharges. Therefore, these laws and corresponding regulations have been inadequate to halt population declines and degradation of habitat for the snail.

In addition to the federal listing, the Anthony's riversnail is listed as Endangered by the State of Tennessee and as highest conservation concern by the State of Alabama. Under the Tennessee Nongame and Endangered or Threatened Wildlife Species Conservation Act of 1974 (Tennessee Code Annotated §§ 70-8-101-112), "…it is unlawful for any person to take, attempt to take, possess, transport, export, process, sell or offer for sale or ship nongame wildlife, or for any common or contract carrier knowingly to transport or receive for shipment nongame wildlife." Further, regulations included in the Tennessee Wildlife Resources Commission Proclamation 00-15 Endangered Or Threatened Species state the following: except as provided for in Tennessee Code Annotated, Section 70-8-106 (d) and (e), it shall be unlawful for any person to take, harass, or destroy wildlife listed as threatened or endangered or otherwise to violate terms of Section 70-8-105 (c) or to destroy knowingly the habitat of such species without due consideration of alternatives for the welfare of the species listed in (1) of this proclamation, or (2) the United States list of Endangered fauna. Potential collectors of this species would be required to have a state collection permit.

Since listing, section 7 of the Act has required Federal agencies to consult with the Service when projects they fund, authorize, or carry out may affect the species. However, the lack of Federal authority over the many actions likely impacting Anthony's riversnail habitat has become apparent. Many of the threats (including those identified at the time of listing, during recovery planning, and since development of the Recovery Plan) involve activities that likely do not have a Federal nexus (such as water quality changes resulting from development, water withdrawals, or

logging) and, thus, may not result in section 7 consultation. Although the take prohibitions of section 9 of the Act do apply to these types of activities and their effects on the Anthony's riversnail, enforcement of the section 9 prohibitions is difficult. The Service is not informed when many activities are being considered, planned, or implemented; therefore, we have no opportunity to provide input into the design of the project or to inform project proponents of the need for a section 10 permit.

Through section 7 consultations with the Tennessee Valley Authority and the U.S. Army Corps of Engineers, the Service has obtained funding to determine the status of the snail in the Tennessee River from Nickajack Dam to Bridgeport, Alabama. Additional funding was also provided to propagate the snail along with several large-river mussel species.

e. Other natural or manmade factors affecting its continued existence:

The Anthony's riversnail's limited geographic range and apparent small population size leaves the species extremely vulnerable to localized extinctions from accidental toxic chemical spills or other stochastic disturbances and to decreased fitness from reduced genetic diversity. Potential sources of such spills include potential accidents involving vehicles transporting chemicals over road crossings of streams inhabited by the snail and accidental or intentional release into streams of chemicals used in agricultural or residential applications.

The Anthony's riversnail's small population size naturally makes it vulnerable to losses in genetic diversity and fitness. Species that are restricted in range and population size are more likely to suffer loss of genetic diversity due to genetic drift, potentially increasing their susceptibility to inbreeding depression and decreasing their ability to adapt to environmental changes (Allendorf and Luikart 2007).

D. Synthesis

Anthony's riversnail is known from only three disjunct populations in the Tennessee River system: the Tennessee River, Sequatchie River, and Limestone Creek. The species prefers medium to large river habitats with cobble/boulder substrates in the vicinity of riffles with strong current. Population demographics are only available for the Limestone Creek population, which appeared to be a viable population in 2010. However, that viability is now in question. 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 the snail rangewide. The species also remains highly vulnerable to increased urbanization and potential stochastic events, such as toxic chemical spills. Overutilization for commercial or other purposes and disease/predation are not known to have major impacts to the species.

Due to the limited distribution, small population size, and continued threats to Anthony's riversnail, it continues to be in danger of extinction throughout its range. Therefore, the status of

Anthony's riversnail listed as endangered remains appropriate. The species has been successfully propagated, however, due to water and habitat quality degradation the success of potential reintroductions is uncertain.

III. RESULTS

A. Recommended Classification:

__X__ No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS -

Continue to monitor population levels at all three populations (Tennessee River, Sequatchie River, and Limestone Creek), demographics, and habitat conditions of existing populations, especially the Tennessee and Sequatchie river populations.

Continue efforts aimed at obtaining individuals and improving techniques necessary for captive propagation of the species. Any experimental populations that are established through augmentation should be monitored genetically and population growth noted to be compared with non-augmented populations to determine whether fitness is enhanced or diminished from the introduction of unique haplotypes from other populations (Minton and Savarese 2005).

As identified by the Cumberlandian Region Mollusk Restoration Committee (CRMRC), priority actions for the species include: continue reintroductions into Wilson Dam tailwater, complete updated survey efforts in the Sequatchie River, and determine if translocations into the Nolichucky River are warranted (CRMRC 2009). The CRMRC (2009) lists the Wilson Dam tailwater NEP, the lower French Broad and Holston rivers NEP, and the Nolichucky River as potential reintroduction streams.

Any translocations that are conducted should use the Limestone Creek population as it is the most robust and has been more closely monitored (Garner and Haggerty 2010). Minton and Savarese (2005) further suggest that only juveniles be involved in translocations as they are easier to identify.

Continue to utilize existing legislation and regulations (Federal and State endangered species laws, water quality requirements, stream alteration regulations, etc.) to protect the species and its habitat.

Continue to work with the Tennessee Valley Authority to ensure that operations at Nickajack Dam remain protective of the species and its large river habitat downstream from the dam.

Continue efforts to reduce non-point pollution from agricultural activities by working through the Partners for Fish and Wildlife, Farm Bill, and other landowner incentive programs to implement best management practices.

V. REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Anthony's riversnail (*Athearnia anthonyi*)

Current Classification: Endangered
Recommendation resulting from the 5-Year Review

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change is needed

Review Conducted By: Stephanie Chance, Tennessee Ecological Services Field Office.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Mary E Jennings Date 2/25/11

REGIONAL OFFICE APPROVAL:

for
Lead Regional Director, Fish and Wildlife Service

Approve [signature] Date 3-11-11

FY 2018 APPROVAL*

Lead Field Supervisor, Fish and Wildlife Service

Approve Mary E. Jennings Date 2/8/18

* In 2014, Southeast Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.
Field Supervisor signature on this document reflects:

1. __X__ We have no new information, received no new public comments, and the original five factor analysis remains an accurate reflection of the species current status.
2. _____ We have obtained a small amount of new information that we have summarized in Appendix B, received no new public comments, and the original five factor analysis remains an accurate reflection of the species current status.

*APPENDIX A: Summary of peer review for the 2011 5-year review of Anthony's riversnail (***Athearnia anthonyi***)*

A. Peer Review Method: On June 29, 2010, an email was sent to biologists from the Alabama Department of Conservation and Natural Resources and the University of Louisiana at Monroe asking for peer review of the draft Anthony's riversnail 5 year review. These individuals are considered to be species experts.

B. Peer Review Charge: Peer reviewers were asked to pay special attention to discussions of existing populations, genetics, taxonomic classification, and recommendations for future actions.

C. Summary of Peer Review Comments/Report – The Alabama Department of Conservation and Natural Resources provided a published journal article that was only included as "in press" in the 5 year review. No other comments were provided.

D. Response to Peer Review – Citations for the Garner and Haggerty (2010) article were updated throughout the document.