

Royal Marstonia (Snail)
(Pyrgulopsis [=Marstonia] ogmorhappe)

5-Year Review
Summary and Evaluation



(Photo courtesy of David Withers, TDEC)

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

5-YEAR REVIEW

Royal Marstonia (Snail) (*Pyrgulopsis [=Marstonia] ogmorhapse*)

I. GENERAL INFORMATION

A. Methods Used to Complete the Review

The U.S. Fish and Wildlife Service (Service) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 et seq.). The public notice for this review was published in the *Federal Register* on April 11, 2019 (84 FR 14669) with a 60-day public comment period. In the notice, the Service requested new information regarding the Royal Marstonia that has become available since the last 5-year review for the species. No public comments were received.

In conducting this 5-year review, we relied on available information pertaining to historic and current distributions, life history, and habitat of this species. Our sources include the Recovery Plan; peer-reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts.

We did not seek external peer review for this 5-year review because it was not considered “influential” under the Service’s policy for Information Quality Guidelines and Peer Review. Per the guidelines, the Service will seek peer review when we can reasonably determine that dissemination of influential information “...will have or does have a clear and substantial impact on important public policy or private sector decisions, and thus, a decision or action to be taken by the Director”, such as a change in listing status (i.e., delisting, downlisting, or uplisting of a species). This 5-year review was reviewed internally by Anthony Ford with the Service, Tennessee Field Office, and Evan Collins with the Service, Alabama Field Office. Santiago Martín (species recovery lead) with the Service, Tennessee Field Office, completed the review. Appendix A provides a brief summary of the peer-review approach.

B. Reviewers

Lead Field Office – Cookeville, Tennessee, Ecological Services: Santiago Martín, (931) 525-4987

Cooperating Field Offices

Daphne, Alabama, Ecological Services: Evan Collins, (251) 441-5837

C. Background

1. Federal Register Notice citation announcing initiation of this review:

84 FR 14669 (April 11, 2019)

2. Species Status: Stable.

The Royal Marstonia is a narrow-range, endemic snail that is only known from two spring runs in the Sequatchie River basin in Marion County, Tennessee. In Town Creek, the Royal Marstonia is commonly found from the spring source (i.e., Blue Spring) to approximately 393.7 feet (120 meters) downstream (TDEC 2016). In Owen Spring Branch, the Royal Marstonia is commonly found from the emergence of Owen Spring at the mouth of Sequatchie Cave to approximately 164 feet (50 meters) downstream (TDEC 2016).

Recently, the Alabama Aquatic Biodiversity Center completed a life history study (AABC, 2019) for this species from samples collected between August 2012 and May 2013. Sample sizes of 6,493 and 3,481 for the entire project at Owen Spring Branch and Town Creek, respectively, indicate that, while spatially constrained, the Royal Marstonia is locally abundant.

3. Recovery Status: 1 (1 = 0%-25% of recovery objectives achieved). No major habitat improvement efforts have been completed since the last 5-year review (Service 2011). However, local volunteers and Tennessee Department of Environmental Conservation (TDEC), Tennessee Wildlife Resources Agency, and Service personnel are engaged in regular upkeep (e.g., trash pickup events) at Sequatchie Cave State Natural Area (SCSNA). In addition, TDEC (2016) has prepared a conservation strategy for the Royal Marstonia at SCSNA that summarizes the current status of the species and its habitat and outlines future conservation actions that need to be completed at SCSNA.

4. Listing History

Original Listing

FR notice: 59 FR 17994

Date Listed: April 15, 1994

Entity Listed: Species

Classification: Endangered

5. Associated Rulemakings:

June 27, 2019. Endangered and Threatened Wildlife and Plants; 29 Draft Recovery Plan Revisions for 43 Species in the Pacific, Southwest, and Southeast Regions of the United States (84 FR 30764).

6. Review History:

Each year, the Service reviews and updates listed species information for inclusion in the required Recovery Report to Congress. Through 2013, we submitted information for the annual recovery data call that included status

recommendations like “Stable” or “Uncertain” for the Royal Marstonia. The most recent evaluation for this species was completed in 2019.

The Service noticed a 5-year review for the Royal Marstonia in 2006 (71 FR 42871), which was completed in 2011 (Service 2011). In this review, the Service did not recommend a change in listing status based on continued threats to the species from degradation of habitat and water quality, its limited and disjunct populations, and vulnerability to stochastic (i.e., random) events.

7. **Species’ Recovery Priority Number at start of 5-year review (48 FR 43098):**
5 – This Recovery Priority Number indicates that the Royal Marstonia is categorized as a species, has a high degree of threat, and the potential for recovery is low.

8. **Recovery Plan:**

Name of plan: Recovery Plan for Royal Snail (*Pyrgulopsis ogmorhapse*)

Date issued: August 11, 1995

Date amended: September 27, 2019

II. REVIEW ANALYSIS

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

The ESA defines “species” as including any subspecies of fish, wildlife, or plant, and any DPS of any species of vertebrate wildlife. This definition limits listing DPSs to only vertebrate species of fish and wildlife. Because the species under review is an invertebrate, the DPS policy is not applicable and will not be addressed further in this review.

B. Recovery Criteria

1. **Does the species have final, approved recovery plan containing objective, measurable criteria?**

Yes. While the original recovery plan did not include any downlisting or delisting criteria, an amendment to the recovery plan was finalized on September 27, 2019. The amendment only included delisting criteria (see section II.B.3).

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 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.

The Service will consider the Royal Marstonia for delisting when the following criteria are met:

(1) The two (2) existing populations occupying Town Creek and Owen Spring Branch exhibit stable or increasing trends, as evidenced by snail densities, size-class distribution, and spatial extent of occupied habitat.

Status: This criterion has not been met. Historically, the Royal Marstonia has been found in Owen Spring Branch between the Sequatchie Cave entrance and a short distance past the State Route 27 Bridge, approximately 0.21-mile (~338 meters). In Town Creek, the Royal Marstonia has been found between the emergence of Blue Spring and the U.S. 64 Bridge, approximately three stream miles (~ 4.82 kilometers) (TDEC 2016). However, the species distribution has varied over the years due to habitat changes (e.g., beaver dams, sedimentation, pollution) and is now reduced. Currently, the Royal Marstonia is easily found within 164 feet (50 meters) and 393.7 feet (120 meters) from the headwaters of Owen Spring Branch and Town Creek, respectively. The core range is significantly lower than the species' potential range based on anecdotal observations (TDEC 2016).

A monitoring program to track snail densities, size-class distribution, and spatial extent over time has not been developed. Thus, we lack the trend data necessary to address this recovery criterion.

(2) Threats have been addressed and/or managed to the extent that the species will remain viable for the foreseeable future.

Status: This criterion has not been met. While stream bank improvements at SCSNA have helped the Owen Spring Branch population by reducing sediment inflows, major threats are unmitigated or poorly understood. For example, beaver dams have reduced flow velocities in sections of Owen Spring Branch and Town Creek, creating impounded stream reaches above dams; impounded stream reaches, in turn, allow for the accumulation of sediments, which has altered habitat previously occupied by the Royal Marstonia. Besides increasing sedimentation, impounded streams tend to have warmer water temperatures, which can reduce Royal Marstonia survival and reproduction. Lastly, our limited knowledge of the recharge areas for Owen Spring and Blue Spring make the species susceptible to stochastic events in upstream portions of the watershed that may extirpate a population. For a more thorough discussion on threats to the Royal Marstonia please see section II.C.2.

C. Updated Information and Current Species Status

1. Biological and Habitat

a. Abundance, population trends, demographic features or demographic trends

The AABC (2019) collected quarterly demographic data from both Royal Marstonia populations between August 2012 and May 2013. Snails were collected every month, with most snails sampled in both populations ranging in size from 1.5 to 3 mm, regardless of the month. Larger snails (3.01 to 4 mm) were routinely collected in Owen Spring Branch, but were only observed in Town Creek in August. Juveniles (≤ 0.50 mm) were collected every month, but observed densities dropped precipitously in November, with only one individual collected at Blue Spring.

Based on the size distributions at both populations, the maximum age for most Royal Marstonia is estimated to be approximately one year, with a small subset of the population that survives for two years (AABC 2019). However, individuals larger than 3.01 mm were likely undersampled due to the collection methods used (AABC 2019). Therefore, more demographic studies are needed to more accurately estimate the proportion of individuals in Owen Spring Branch and Town Creek that survive more than one year.

Royal Marstonia recruitment occurred from mid-winter to early spring, which is common for most species in the family Hydrobiidae (Johnson et al. 2013). The large percentage of individuals observed in the mid-size classes and the collection of juveniles (≤ 0.50 mm) throughout the year indicate near-continual recruitment, which is likely the result of near isothermal (i.e., similar temperature) conditions characteristic of spring run systems.

b. Genetics, genetic variation, or trends in genetic variation

Strong et al. (2018) recently completed a preliminary phylogenetic review (i.e., a study of the evolutionary history and relationships among species) of the genera *Marstonia* and *Somatogyrus* within the Mobile and Tennessee River basins in Alabama, Tennessee, and Georgia. The results of this study were inconclusive regarding the relationship of samples attributed to the lustrica clade (i.e., a grouping that includes a common ancestor and all its descendants), which included the Royal Marstonia and the Armored Marstonia (*Pyrgulopsis [=Marstonia] pachyta*). Strong et al. (2018) concluded that the lustrica clade's genetic structure may be the result of geographic variation for one widely distributed species or may be attributed to inter-specific variation (Strong et al., n.d.). Future genetic work should focus on clarifying the relationship between Royal Marstonia, Armored Marstonia, and related taxa.

c. Taxonomic classification or changes in nomenclature

The nomenclature for the Royal Marstonia has changed since its description. Thompson (1977) noted the close morphological similarity between *Marstonia*

and eastern species of *Pyrgulopsis*, but he continued to recognize them as separate genera. Herschler and Thompson (1987) synonymized *Marstonia* with *Pyrgulopsis* largely based on morphological characteristics of *P. nevadensis* (the poorly-known type species of *Pyrgulopsis*). However, Thompson and Herschler (2002) re-evaluated eastern North American species assigned to *Pyrgulopsis*; based on strongly differentiated morphological characteristics between eastern and western congeners of *Pyrgulopsis*, and they recognized the Eastern taxa as distinct species of the genus *Marstonia*.

A recent publication by Johnson et al. (2013) on the conservation status of freshwater gastropods of Canada and the United States favored the use of *M. ogmorhapse*. The Integrated Taxonomic Information System (ITIS 2020) lists both *M. ogmorhapse* and *P. ogmorhapse* as valid, although only *P. ogmorhapse* shows a record credibility rating of “verified,” meaning that all standards have been met. Our nomenclature is consistent with and follows the ITIS.

d. Spatial distribution, trends in spatial distribution, or historic range (e.g., corrections to the historical range, change in distribution of the species within its historical range, etc.)

The Royal *Marstonia* is a narrow-range, endemic snail that is only known from two spring runs in the Sequatchie River basin in Marion County, Tennessee. The Owen Spring/Owen Spring Branch population is located in the Town of Sequatchie, while the Blue Spring/Town Creek population is located in the City of Jasper. Historically, the Royal *Marstonia* has been found in Owen Spring Branch between the first pool at the headwater of this stream and a short distance past the State Route 27 Bridge, approximately 0.21-mile (~338 meters). In Town Creek, the Royal *Marstonia* has been found between the emergence of Blue Spring and the U.S. 64 Bridge, approximately three stream miles (~ 4.82 kilometers) (TDEC 2016). However, its distribution has varied over the years due to habitat changes (e.g., beaver dams, sedimentation, pollution). Currently, the Royal *Marstonia* is easily found within 164 feet (50 meters) and 393.7 feet (120 meters) from the headwaters of Owen Spring Branch and Town Creek, respectively. The core range is significantly lower than the species’ potential range based on anecdotal observations (TDEC 2016).

Two surveys for the Royal *Marstonia* have been completed to date. Gordon (1991) was the first to conduct a comprehensive survey of aquatic mollusk fauna within Sequatchie Valley, encompassing 76 survey sites; this survey resulted in the discovery of the second Royal *Marstonia* population at Blue Spring. The second survey was completed by the Tennessee Division of Natural Heritage (TDNH, 2003) in areas within and proximal to the Sequatchie Valley in Cumberland, Bledsoe, Sequatchie, and Marion counties. This latter survey targeted 51 sites containing first order streams and springs suitable for Royal *Marstonia*, but no additional populations of this species were found. The report concluded that the likelihood that this species occurs naturally elsewhere in the Sequatchie Valley is minimal.

e. Habitat conditions

Since the Recovery Plan was developed in 1995, the significance of adverse effects to Royal Marstonia habitat as a result of beaver activity has become more apparent. Both populations are constrained by downstream beaver activity that results in formerly free-flowing, cold water sections of stream becoming inundated and inaccessible to the Royal Marstonia. Although this is most notable in Town Creek, beavers are also active in Owen Spring Branch, and a dam was found on the creek in SCSNA. There are no long-term commitments in place to control beaver populations in either spring.

The Town Creek population of Royal Marstonia does not appear to extend downstream of the US 64/72 bridge in Jasper, likely due to the continuing influence of beaver damming in the system. The headwaters of Town Creek (Blue Spring) are owned by the Town of Jasper and are surrounded by the town water treatment plant. In late 2002, the water treatment plant removed extensive riparian vegetation from a portion of Town Creek immediately downstream of Blue Hole Spring. The area around the water treatment plant currently remains devoid of most riparian vegetation. Additionally, the water treatment plant removed a series of trout runs in 2002 that were a part of a former hatchery and had been occupied by the Royal Marstonia.

There has been some improvement in habitat conditions at localized areas as a result of conservation actions taken by state and local governments since 1995. For example, the riparian zone of Owen Spring Branch near Sequatchie Cave appears to have stabilized since completion of the restoration work in 2000. The snails reoccupied those portions of the littoral zone that were most impacted prior to 1999-2000. However, evidence of off-road vehicle (ORV) use in the stream was noted during 2007 (TDEC 2016).

More subtle aspects of habitat quality, such as various water quality parameters, have not been monitored routinely. However, there appears to be some impact to water temperature and flow regime in the downstream portion of Owen Spring Branch as a result of beaver activity and the influence of a man-made canal (known as “The Lagoon”). The Lagoon diverts water from the Little Sequatchie River, depending on the flood stage, and was used in the past to power an electricity generator adjacent to Owen Spring Branch (TDEC 2016). In 2011, TDEC measured water temperature, dissolved oxygen, pH, and specific conductivity at Owen Spring, The Lagoon, and below the State Route 27 Bridge. While there were differences in these water quality parameters at the three sampled points, it is not clear whether these water quality parameters and/or The Lagoon are limiting Royal Marstonia distribution.

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 at the time of listing and in the recovery plan, degradation of habitat and water quality remain the biggest threats to the Royal Marstonia, the magnitude of which we could be underestimating due to lack of information on the Blue Spring and Owen Spring recharge areas. Since the recovery plan was prepared, several specific threats to habitat have become apparent.

Beaver activity in both the Town Creek and Owen Spring Branch drainages has impacted Royal Marstonia habitat and is likely to continue to threaten habitat. Formerly free-flowing, cold water sections of Town Creek are now wholly inundated and inaccessible to the Royal Marstonia. In Town Creek, the snail population does not appear to extend downstream of the US 64/72 bridge in Jasper because of beaver activity. Although the stream was cleared of beavers in 2000, beavers returned by 2002, and their activity currently continues unchecked, with associated adverse impacts to the snail's habitat. Downstream portions of the Owen Spring Branch are also being impacted by beaver activity. A beaver dam occurred on SCSNA during 2007. The dam was removed in 2008, but beaver activity continues with no long-term plans for control.

Human activities have impacted Royal Marstonia habitat and will likely do so in the future. For example, the headwaters of Town Creek have been adversely impacted by activities at the Town of Jasper's water treatment plant. In late 2002, the water treatment plant elected to remove extensive riparian vegetation from a portion of Town Creek, as well as to remove a series of trout runs that were part of a former hatchery. Town Creek currently remains devoid of normal riparian vegetation in the vicinity of the water treatment plant (TDEC 2016). The Royal Marstonia occurred in the trout runs, as well as in the portion of Town Creek used as a crossing for heavy equipment. No permits were obtained for this work. TDNH continues to meet with Jasper water treatment plant staff to discuss plant operations and potential measures that could be taken to improve habitat for the snail at the site (TDEC 2016), but no commitments have been made.

In August 1998, a portion of the stream bottom of Owens Spring Branch downstream of SR 27 was covered by a layer of sawdust and silt as a result of dumping of wood waste by a local factory (TDNH 2000). The sawdust was removed and the bank re-seeded. Additional attention is still needed to restore portions of the stream and address other pollution issues. The handle factory continues to threaten potential habitat in Owens Spring Branch (TDEC 2016). Subtle changes in water quality parameters may result from activities taking place elsewhere within the springs' recharge zones and may occur without prompt detection. For example, there are anecdotal reports of turbidity at Blue Hole Spring and in Town Creek with some speculation that the turbidity could be

associated with activities at the water treatment plant or activities at a quarry in the drainage, although monitoring has not been in place to determine the source of the turbidity or whether water quality has been impaired during these episodes.

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

Owen Spring Branch was significantly impacted by human activities near Sequatchie Cave prior to 1999. Littering, dumping, and ORV use significantly damaged the riparian area and caused a direct loss of snail habitat. Restoration work occurred in 2000 and included installation of barriers to keep ORV's out of the stream, as well as vegetation planting and recontouring of the riparian zone. ORV traffic in the stream became virtually non-existent and snails reoccupied the areas that had been most impacted prior to the restoration work. However, maintenance of barriers near the stream is needed and evidence of limited ORV use in the stream has become evident again (TDEC 2016). While there is currently no ORV use in the stream; water withdrawal, passive recreation, social gatherings, and wildlife viewing activities are still considered to threaten Royal Marstonia habitat at SCSNA (TDEC 2016).

c. Disease or predation

The Service did not identify disease or predation as threats in the previous 5-year review (Service 2011). We do not have new information indicating that this has changed.

d. Inadequacy of existing regulatory mechanisms

The Royal Marstonia 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 (T.C.A. 69-3-101). These laws focus on point-source discharges; however many water quality problems are the result of non-point source discharges. Therefore, these laws and corresponding regulations are inadequate to prevent population declines or habitat degradation.

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 Royal Marstonia 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 or indiscriminate 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 Royal Marstonia, enforcement of the section 9 prohibitions is difficult, at best. 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.

In addition to the federal listing, the Royal Marstonia is listed as Endangered by the State of Tennessee. 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.

Tennessee's Natural Areas Preservation Act of 1971 (T.C.A. 11-14-101) (Appendix I) provides the best protection for the Royal Marstonia and its habitat in SCSNA. Sequatchie Cave and a portion of Owen Spring Branch are designated by law as a Class II natural area under the Natural Areas Preservation Act. The classification is "natural-scientific..., which are areas associated with and containing floral assemblages, forest types, fossil assemblages, geological phenomena, hydrological phenomena, swamplands and other similar features or phenomena that are unique in natural or scientific value, and are worthy of perpetual preservation" (T.C.A. 11-14-105). The area is managed in accordance with the rules of the Tennessee Department of Environment and Conservation (Chapter 0400-2-8, Appendix II).

e. Other natural or manmade factors affecting its continued existence

The recovery plan identified the introduction or invasion of nonnative species into either spring run inhabited by the Royal Marstonia as a serious threat. The invasion or introduction of nonnative aquatic weeds into the spring runs could eventually result in the elimination of the habitat required by the Royal Marstonia and require intensive and potentially harmful control measures. Additionally, terrestrial nonnative weeds, or their control, may be a threat to the habitat of the Royal Marstonia. As part of the riparian restoration project along Owens Spring Branch near Sequatchie Cave in 2000, the Tennessee Division of Natural Heritage (TDNH) and the Marion County Highway Department made a concerted effort to remove invasive exotic plants (primarily Chinese privet and multiflora rose) that were excluding native riparian vegetation from the project area (TDEC 2016). The exotics were cut and removed, followed by herbicide treatment of stumps and sprouts. Kudzu has been problematic at the SCSNA, advancing to within

approximately 450 feet (~137 meters) of the snail's habitat in Owen Spring during 2005. In coordination with the Service, the Tennessee Division of Natural Areas developed a management prescription for treatment of kudzu at the natural area, with treatment measures including mechanical removal as well as herbicide application.

The Royal Marstonia is vulnerable to extinction from stochastic events by virtue of being a narrow-range, endemic snail. This vulnerability is exacerbated by its short life cycle, making it susceptible to extinction even when stochastic events are short-term in duration. Because the populations are physically isolated from each other, recolonization of an extirpated population would not be possible without human intervention. Given the potential for genetic differences between the two populations, human-assisted repopulation or augmentation may be inappropriate. Additionally, because natural gene flow among populations is not possible, the long-term genetic viability of these isolated populations is questionable.

D. Synthesis

The Royal Marstonia is a narrow-range, endemic snail that is only known from two spring runs in the Sequatchie River basin in Marion County, Tennessee. Total occupied habitat for the species is currently less than 656 linear feet (~ 200 linear meters) of spring run habitat at these two locations. Habitat and water quality degradation are the greatest threats to the species. The recharge areas for the springs are unknown, so it is difficult to evaluate the geographic scope within which threats may be occurring. Its habitat has been impacted by several types of human activities including direct habitat destruction at the Town of Jasper's water treatment plant and ORV use in the Owen Spring Branch. Additionally, beaver activity constrains Royal Marstonia use of downstream habitat in both Town Creek and Owen Spring Branch. The limited and disjunct distribution of the Royal Marstonia populations, as well as the snail's short life cycle, makes it vulnerable to extinction from stochastic events that may be highly localized, short in duration, and difficult to detect.

The recovery criteria listed in Section II.B.3 above have not been met. Due to the Royal Marstonia's limited distribution and continued threats to the two populations, it remains in danger of extinction throughout all or a significant portion of its range. Therefore, the status of the Royal Marstonia should remain as endangered.

At the time of listing (Service 1994), this species had a high degree of threat and a low recovery potential, which results in a Recovery Priority Number of 5 for the taxonomic level of species. The Recovery Plan (Service 1995) does not specifically address the Recovery Priority Number; however, the Recovery Plan does describe significant threats for this species and little potential for full recovery. Threats to this species remain high and the

recovery potential remains low. Therefore, a change to the existing Recovery Priority Number is not warranted.

III. RESULTS

A. Recommended Classification: Endangered

IV. RECOMMENDATION FOR FUTURE ACTIONS

1. Implement a long-term beaver control program in Owen Spring Branch and Town Creek.
2. Delineate the recharge zone for both springs.
3. Investigate genetic differences between Royal Marstonia populations as well as clarify the relationship of this species with other Marstonia species (see section II.C.1.b).
4. Investigate approaches to estimating population abundance. Develop a protocol for and implement a program to monitor important Royal Marstonia population parameters.
5. Determine the species' limits for various water quality parameters (e.g., water temperature, dissolved oxygen, conductivity, and pH).
6. Investigate the need for and potential to regulate flow from "The Lagoon" into Owen Spring Branch.
7. Restore degraded littoral habitat in both the Town Creek and Owen Spring Branch drainages, with priority given to those areas closest to occupied habitat.
8. Within the recharge zone, protect habitat on public lands through formal agreements and management plans.
9. Within the recharge zone, protect habitat on private land through acquisitions and easements, where possible.
10. Work with the Town of Jasper to develop and implement a plan to provide for conservation of the Royal Marstonia in the vicinity of, and downstream of, the Jasper Water Treatment Plant.
11. Develop a program for monitoring water quality and habitat conditions in occupied habitat.
12. Develop artificial holding and propagation technology.

V. REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of
Royal Marstonia (*Pyrgulopsis [=Marstonia] ogmorhaphae*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

Downlist to Threatened

Uplist to Endangered

Delist

No change is needed

Review conducted by: Santiago Martín, Tennessee Field Office, Cookeville, Tennessee

FIELD OFFICE APPROVAL:

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

Approve _____ Date 03/30/2020

APPENDIX A: Summary of peer review for the 5-year review of the Royal Marstonia (*Pyrgulopsis [=Marstonia] ogmorhapse*)

Peer Review Method:

Pursuant to Service policy, no external peer review was conducted. This document was peer-reviewed internally by Service biologists: Anthony Ford with the Tennessee Field Office and Evan Collins of the Alabama Field Office. Evan Collins is the species recovery lead for Armored Marstonia, which is closely related to Royal Marstonia.

No formal public comments were received following the Federal Register Notice citation announcing initiation of this review. Since minimal new information was obtained since the last 5-year review in 2011 and we did not recommend a change in listing status, we did not seek external independent peer review of this document. As we continue to support recovery actions for the species with partners, we look forward to having additional data for our next 5-year review and will conduct a peer review as necessary and according to established Service policy.