

**Carolina Heelsplitter
(*Lasmigona decorata*)**

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



Photo Credit: USFWS

**U.S. Fish and Wildlife Service
Southeast Region
South Carolina Ecological Services Field Office
Charleston, South Carolina**

with major contributions from

Asheville Ecological Services Field Office

July 18, 2025

5-YEAR STATUS REVIEW

Carolina Heelsplitter (*Lasmigona decorata*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Ecological Services Field Office, Charleston, South Carolina – Melissa Chaplin.

Reviewers:

Lead Regional Office: Southeast Region, Carrie Straight.

Cooperating Field Office(s): Ecological Services Field Office, Asheville, North Carolina – Jason Mays.

Date of original listing: July 30, 1993 (58 FR 34926; June 30, 1993).

Critical Habitat: Critical habitat final rule: July 2, 2002 (67 FR 44502).

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 Carolina heelsplitter's biology, habitat, and threats of to inform this status review.

We announced initiation of this review in the Federal Register on May 11, 2023 (88 FR 30324) with a 60-day comment period and received one comment. We received one public comment from the National Council for Air and Stream Improvement, Inc. This comment requested that we consider their assertion that forestry best management practices (BMPs) are effective for protecting water quality and habitat for at-risk species. We discuss timber harvest practices, BMPs, and potential impacts to Carolina heelsplitter under Factor A in the Threats section.

The primary sources of information used in this analysis were the 1993 final listing rule (58 FR 34926), 1997 recovery plan, the 2012 and 2019 5-year reviews, peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. This review was completed by the U.S. Fish and Wildlife Service, Asheville Ecological Services Office, Asheville, North Carolina and the South Carolina Ecological Services Field Office, Charleston, South Carolina. All literature and documents used for this review are on file at the South Carolina Field Office. Along with information and data received from state agencies, we received one public comment from the National Council for Air and Stream, Inc. A completed draft of this 5-year review was sent to other affected Service offices in the species' range for review and comment. All comments

received were evaluated and incorporated into this final document as appropriate. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the Carolina heelsplitter.

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 FR 43098](#)):

5C. This number indicates a high degree of threat and low recovery potential.

Review History:

A previous 5-year review recommending no change in status was signed on June 20, 2012 (Service 2012).

A previous 5-year review recommending no change in status was signed on May 21, 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 a not a vertebrate, the DPS policy does not apply.

Recovery Criteria

Recovery Plan or Outline

Final Recovery Plan for the Carolina heelsplitter (*Lasmigona decorata*), January 17, 1997 (Service 1997).

Recovery plans are not regulatory documents. They 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 five downlisting criteria (criteria to reclassify the species from endangered to threatened) for Carolina heelsplitter, based on the 1997 Recovery Plan are:

1. Through protection of existing populations, successful establishment of reintroduced populations, or the discovery of additional populations, a total of four distinct viable populations exist. These four populations must be distributed throughout the species' known historic range, with at least one each in the Catawba, Pee Dee, and Savannah River systems. Also, these populations must be extensive enough that it is unlikely that a single event would eliminate or significantly reduce one or more of them.
2. Two distinct naturally reproduced year classes exist within each of the four populations. One of these year classes must have been produced within the 5 years prior to the time the species is reclassified from endangered to threatened. Within the year prior to the downlisting date, gravid females and the mussel's host fish must be present in each populated river/stream reach.
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 an increase in population density and/or an increase in the length of the river reach inhabited by each of the four populations.
4. Where habitat has been degraded, noticeable improvements in channel stability, water and substrate quality, and associated biota have occurred.
5. Each of these four populations and their habitats are protected from any present and foreseeable threats that would jeopardize their continued existence.

The Service believes these criteria are appropriate and relevant; however, no criteria have currently been met. Carolina heelspitter is still extant in each of the drainages in criterion 1, however the long-term stability of the populations is not assured. The population in the Pee Dee River, primarily in Flat Creek of the Lynches River, is extant and Carolina heelspitter are frequently observed during survey efforts, the area that is known to be occupied is only a 2-3-mile-long reach and no other occupied areas are currently known. The population in the Savannah River is likely the most extensive with occurrences in multiple tributary streams but the number of observations in each stream is low. The population in the Catawba has continued to decline and verified occurrences are rare. The observed low population levels make it unlikely the species is resilient to disruptive events.

Additionally, due to the low population levels in most streams, verifying recent reproduction is difficult. In general, the younger year classes of mussel species remain buried below the substrate and are rarely encountered. In the case of the Carolina heelspitter, the few individuals that are observed are typically adult sized and difficult to age with reliability. Based on population trends, it is possible that there is some level of recruitment in the Flat Creek population due to frequent observations and the occurrence of a few individuals on the lower end of adult size distribution (Wolf pers. comm, 2024). The Turkey Creek population in the Savannah River is only producing low numbers of older individuals and there is no information to confirm recent reproduction (Beason pers. comm, 2024). The population in the Catawba River is low enough that the population is probably not recruiting.

Efforts are underway to improve the technology necessary to rear Carolina heelsplitter in captivity and release them back into the wild. Carolina heelsplitter have been successfully reproduced at the North Carolina Conservation Aquaculture Center in Marion, North Carolina; the Orangeburg National Fish Hatchery in Orangeburg, South Carolina; and the Cohen Campbell Fish Hatchery in West Columbia, South Carolina. Presently these three facilities are cooperating to produce and grow out Carolina heelsplitters for release back into the wild. To date, Carolina heelsplitters have been stocked out in five streams distributed throughout the range: Turkey Creek (Savannah R.), Gills Creek, Waxhaw Creek and South Fork Fishing Creek (Catawba R.), and Flat Creek (Pee Dee R.). Due to the difficulty of relocating mussels after stocking and long generation times of mussels it is unknown if these releases are creating reproducing populations; however, the effort is increasing knowledge of distribution, life history, and genetics of the species while serving as a method to maintain populations and genetics.

Biology and Habitat Summary

There are currently 11 known surviving populations of the Carolina heelsplitter, 2 populations in the PeeDee, 5 in the Catawba, 2 in the Saluda, and 2 in the Savannah River basins.

Pee Dee River:

1. Goose Creek/Duck Creek population, Union County, North Carolina.
2. Flat Creek/Lynches River population including Flat Creek /Lynches River, Lancaster, Kershaw, and Chesterfield counties, South Carolina.

Catawba River:

1. Waxhaw Creek population, Union County, North Carolina, and Lancaster County, South Carolina.
2. Sixmile Creek population, Union and Mecklenburg Counties, North Carolina, and Lancaster County, South Carolina.
3. Gills Creek/Cane Creek population, Lancaster County, South Carolina.
4. Fishing Creek/South Fork Fishing Creek population, Chester County, South Carolina.
5. Rocky Creek population including Bull Run Creek/unnamed tributary to Bull Run Creek/Beaverdam Creek/Hooper Branch, Chester County, South Carolina.

Saluda River:

1. Red Bank Creek population, Saluda County, South Carolina.
2. Halfway Swamp Creek, Greenwood and Saluda counties, South Carolina.

Savannah River:

1. Turkey Creek population, including Turkey Creek/Mountain Creek/Beaverdam Creek/Sleepy Creek/Little Stevens Creek/Rocky Creek/Log Creek, Edgefield and McCormick counties, South Carolina.
2. Cuffytown Creek population, Greenwood and McCormick counties, South Carolina.

During the period from 2019-2024, limited survey efforts were carried out within the range of the Carolina heelsplitter (Table 1; Figure 1). Most of the survey efforts were for the purpose of collecting gravid individuals in the late winter to support the propagation effort. Therefore, most of the survey effort was centered in the populations most likely to produce the needed number of gravid females and tended to be the populations with the highest numbers. No large-scale

population surveys were carried out and some populations were not monitored during this period. In general, very low numbers of Carolina heelsplitter were encountered in the areas surveyed.

Table 1. Observation of Carolina heelsplitter during surveys and numbers of propagated individuals stocked 2019-2024.

Stream Surveys	2024	2023	2022	2021	2020	2019
Sleepy Creek (Savannah)	3		0			
Mountain Creek (Savannah)	4	3	7			
Turkey Creek (Savannah)						4
South Fork Fishing Creek (Catawba)					1	
Gills Creek (Catawba)						1
Waxhaw (Catawba)		5				
Flat Creek (Pee Dee)	12	11	3		1	
Stocking Sites						
Turkey Creek (Savannah)		8		1	13	4
South Fork Fishing Creek (Catawba)				247		
Waxhaw Creek (Catawba)				105		
Flat Creek (Pee Dee)	500			559		

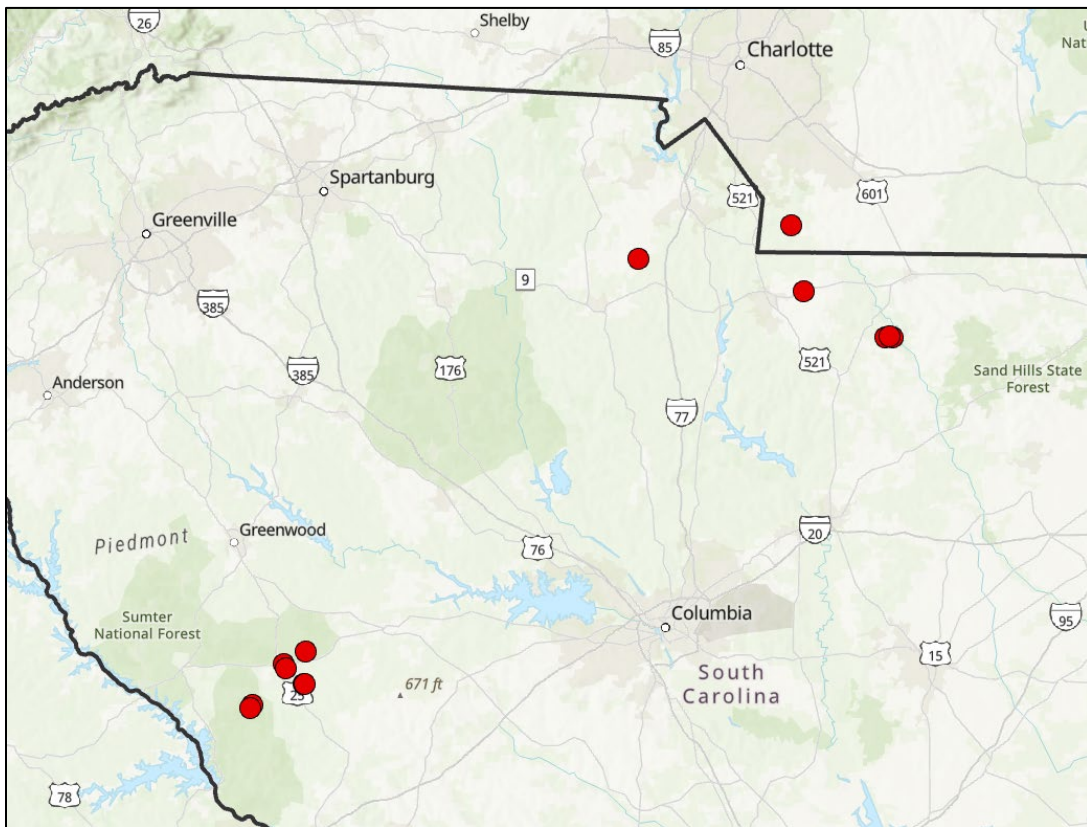


Figure 1. Map showing general location of recent observations of wild Carolina heelsplitter and propagation relocation sites.

Within the extant populations, there are two remaining focal areas where Carolina heelsplitter can be encountered with some frequency: Turkey Creek and tributaries (Sleepy and Mountain creeks) in the Savannah River Basin; and Flat Creek (tributary to the Lynches River in the Pee Dee River Basin).

Within the Turkey Creek watershed, the area of occurrence is spread out over a large area and occupies multiple streams, but there are no known locations where density is high and or where reproduction is obvious. It is likely that Carolina heelsplitter remains extant in multiple locations within this watershed; however, it was noted that individuals encountered all appeared to be in the older age classes and gravid individuals did not have high rates of fertilization (Beason pers. comm., 2024). Both of these observations could indicate a population in decline but the frequency of observation is not sufficient to draw strong conclusions. Due to the large area of potential occupation in this watershed, it is possible that there are areas of reproduction and higher density that are not regularly monitored.

Within Flat Creek, the density of individuals is moderate, but the occupied area is only a short reach of a single stream about 2-3 miles (3-8 km) in length. A short, occupied reach in a single stream increases the vulnerability of the population to catastrophic events. Despite commonly finding multiple adult individuals in a sampling event, there is no direct evidence of recent reproduction in Flat Creek; however, the observance of younger adults and the stability of the adult population over several years makes it likely that there is some level of reproduction taking place in this stream. Flat Creek likely represents the best remaining population of this species and will be an important source population for further propagation efforts.

Goose and Duck Creek in Union County, North Carolina, in the Pee Dee River Basin, have not been surveyed recently, but previous surveys in these streams failed to find any Carolina heelsplitter. The last verifiable record was in 2017. Urbanization in the upper reaches of the watershed is causing habitat degradation in the critical habitat further downstream. The density of other more common mussel species in this watershed have also declined.

In the Catawba River Basin, populations in most of the previously occupied streams have fallen below reliable detection. South Fork Fishing Creek represents the best remaining habitat in the Catawba. There is only one recent record of live Carolina heelsplitter from this watershed. Waxhaw Creek and Gills Creek are sites for active reintroduction of propagated Carolina heelsplitter. Monitoring in Waxhaw indicates that reintroduced individuals are still present and are becoming gravid. Results from Gills Creek are unknown.

In the Saluda River Basin, the populations in Halfway Swamp and Red Bank Creek are only known from a limited number of records (one record from Red Bank Creek in 2006 and one shell from Halfway Swamp Creek in 2008 (see Service 2012)). We have no evidence of current surveys, but we assume that these populations are extremely small if they still persist.

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.

Mussels require stable bedload to form and maintain dense aggregations and it is suspected that their reproduction is dependent on areas of stability where the young can settle and become established. Any disturbance in the watershed that alters the channel form and stability of the bedload is likely to cause a decline in the number of individuals and can prohibit any further recruitment. The distribution of the Carolina heelsplitter places them in a narrow band of geologic formations where the soils are erodible and alterations to hydrologic characteristics such as deforestation or urbanization cause the stream channel to down cut and widen. The instream bedload becomes unstable for long periods of time as the stream seeks to re-establish equilibrium with the new hydrologic regime and generally all mussel species are affected once this process begins. It is possible that the populations are still threatened from hydrological alterations that took place decades ago even if the original stressor is no longer present. The threat of habitat modification is likely to persist in the long term.

The original listing rule (Service 1993) attributed the primary decline of the species to instream habitat degradation caused by land disturbance and erosion from construction, agricultural and forestry activities (Factor A). Another source of habitat degradation came from municipal, industrial, and agricultural pollutants. These impacts to habitat are still the dominant influences negatively affecting the remaining populations. Even when using forestry best management practices more stringent than the recommended state standard, timber harvest and similar forestry activities have been shown to increase discharge rates to the receiving watershed. Increased discharge rates lead to the mobilization of instream sediments and bank instability associated with buffer tree blow down (Boggs et al. 2016), potentially leading to prolonged channel instability.

The growth of urban and suburban development has had a detrimental effect on heelsplitter populations, such as those near Charlotte NC. Urban growth is expected to persist and expand into the future (<https://www.axios.com/local/charlotte/2025/01/23/charlotte-population-growth-2050>). Urban development is having a dramatic effect on populations in both the Pee Dee River System (Goose and Duck Creek), as well as the Catawba River System (Sixmile and Waxhaw Creek) because these watersheds are almost fully urbanized and increased runoff rates are causing stream instability. The remaining populations are further from large population centers but still appear to be threatened by land use, including legacy land use that may still be having an effect on the stability of the ecosystem. It is difficult to pinpoint a single source of disturbance that is responsible for the failure of a habitat to sustain a species like the Carolina heelsplitter in many instances.

We have no information that overutilization for commercial, recreational, scientific, or educational purposes (Factor B) is a limiting factor for the species. In addition, we have no

evidence that disease or predation is a significant threat to the species even though we acknowledge that some individuals will be impacted by predation (Factor C). Although there are some regulatory mechanisms that provide protections to the waters where Carolina heelsplitter occurs (see discussions in Service 1993, 2019 and above), these mechanisms are inadequate to protect the species from all threats (Factor D).

In addition to the primary threat of habitat modification, other factors (Factor E) continue to threaten the Carolina heelsplitter's recovery and ability to persist into the future. All remaining populations of the Carolina heelsplitter appear to be effectively isolated from one another by impoundments, and several of these populations appear to be below the level required to maintain long-term genetic viability. Stream flow in all of the streams within the range of the Carolina heelsplitter has been severely affected in some years by reduced base flows and increased water temperatures associated with prolonged periods of drought conditions and higher than average air temperatures. Long reaches of the stream channel, and in many cases nearly the entire stream channel, have dried up or have been reduced to scattered pools with little or no flow. Populations impacted by severe drought are vulnerable to extirpation. Recolonization may be impossible without human intervention due to isolation between some populations. Extreme heat events and increasing intensity of drought are likely to occur throughout the heelsplitter's range (Frankson et al. 2022, Runkle et al. 2022). Along with periodic drought, the range of the species may undergo extreme precipitation events associated with tropical storms and hurricanes. These extreme events could move stable bedload, wash out individuals from appropriate habitats, and/or bury individuals under sediments. These changes indicate that Factor E could become an increasing threat to the species in the future.

Synthesis

The Carolina heelsplitter is a freshwater mussel inhabiting small streams in a narrow range in the piedmont regions of southern North Carolina and northern South Carolina. The species is represented by 11 extant populations in tributaries of the Savannah, Catawba, and Pee Dee River Basins. Since the previous 5-year review (Service 2019), Carolina heelsplitter has only been observed in seven of these populations for a total of 55 observed. The majority of these observations came from two populations, Flat Creek (Pee Dee) and Mountain Creek in the Turkey Creek population (Savannah). Some populations are represented by only a single observation and other locations have failed to produce any observations in the previous five years. Survey efforts during this period have been generally concentrated in areas with higher probabilities of finding individuals to support propagation efforts. There are no known populations where this species appears to be increasing in abundance and in most populations, there appears to be a declining trend. Flat Creek and Mountain Creek may be exceptions where the already low population density may be stable, but the low frequency of observations make it impossible to verify this hypothesis.

The primary threat to the Carolina heelsplitter continues to be habitat degradation caused by land disturbance and erosion along with water quality degradation from municipal, industrial, and agricultural pollutants. Future threats from water quantity issues (i.e., periods of drought and periods of extreme precipitation) are likely to exacerbate the habitat threats to the species. Due to the low number of extant populations, perceived declining status and the remaining threats to the

species, we recommend that the Carolina heelsplitter still continues to meet the definition of an endangered species.

RECOMMENDED FUTURE ACTIVITIES

A detailed discussion of recovery actions and criteria are presented in the Recovery Plan (Service 1996). In the course of this status review new and/or targeted potential recovery activities were identified and are included below.

1. **Continue and expand propagation.** Due to the extreme rarity of Carolina heelsplitter, recovery will require reintroduction into numerous refugia supported by a robust propagation effort. Many of the streams currently or formerly supporting this species are threatened by human development and effects of climate change and many of these threats cannot be mitigated. A successful reintroduction program should include increased survey efforts that are directed to find remaining locations where this species can reliably be encountered during its breeding season so gravid females can be relocated to hatchery facilities for controlled grow out. To facilitate long term success of the program, it is imperative to find streams in the range of the Carolina heelsplitter where long term threats either do not exist or can be successfully mitigated. Options include protecting streams that are located away from human population centers, restoration or modification of streams to mitigate threats, or streams where the watersheds are substantially protected by public ownership or other controlling factors.
2. **Develop and implement a genetic management plan.** A genetic management plan should be implemented to maximize genetic diversity in each of the reintroduced populations due to the low availability of breeding stock. Successful genetic management may require combining the progeny of several watersheds to provide sufficient genetic variation that the species can thrive and adapt to changing conditions.
3. **Research and characterize habitat requirements.** Additional research activities should be directed to critical factors that affect freshwater mussel populations. It is evident from species distribution that disruption of watersheds and water quality have a detrimental effect on the populations, but the precise factors involved in that disruption are poorly understood. The availability and quality of food resources necessary to sustain a large population of freshwater mussels is currently unknown. Similarly, the habitat characteristics and water quality parameters required are only generally described. A more thorough description of the habitat parameters that are the most crucial to survival would help make decisions about management of existing populations and would guide site selection for reintroductions.

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RESULTS / SIGNATURES

U.S. Fish and Wildlife Service Status Review of Carolina Heelsplitter

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:

Christy Johnson-Hughes, Field Supervisor, South Carolina Ecological Services Field Office, Fish and Wildlife Service

Approve _____