Louisiana Pearlshell
(*Margaritifera hembeli*)

Status Review:
Summary and Evaluation

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U.S. Fish and Wildlife Service
Southeast Region
Louisiana Ecological Services Office
Lafayette, Louisiana

September 2022

STATUS REVIEW
Louisiana Pearlshell (*Margaritifera hembeli*)

GENERAL INFORMATION

Current Classification: Threatened

Lead Field Office: Louisiana Ecological Services Office, Monica Sikes, (337) 291-3118 and Brigette Firmin, (337) 291-3108

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Reviewers:

Louisiana Ecological Services Office: Brigette Firmin, (337) 291-3108

Date of original listing: Endangered on February 5, 1988 (53 FR 3567)

Additional reclassification rules: Threatened on September 24, 1993 (58 FR 49935)

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 biology, habitat, and threats of the Louisiana pearlshell to inform this status review (5-year review).

In conducting this 5-year review, the Service relied on the best available information pertaining to species' historical and current distributions, life history, ecology, habitat, threats, and conservation actions. Much of the information contained herein is taken from a Species Status Assessment (SSA) (Service 2019a) that was prepared by an SSA core team to inform the development of the Final Revised Recovery Plan for the Louisiana Pearlshell (Revised Recovery Plan) (Service 2019b), this and future 5-year reviews, and other Act documents. The SSA core team included a contractor from Texas A&M Natural Resources Institute and two Service biologists from the Louisiana Ecological Services Office. Species' experts from the Louisiana Department of Wildlife and Fisheries (LDWF) and the U.S. Forest Service (USFS) provided technical expertise, and independent peer reviewers and partner representatives provided document review. The SSA represents our evaluation of the best available scientific information, including the resource needs and the current and future condition of the species. Other sources for this 5-year review include the final listing rules, previous 5-year reviews, the Revised Recovery Plan, published and unpublished reports, and personal observations and communications.

Public Comment

We published an announcement in the Federal Register requesting new information on the Louisiana pearlshell as pertinent to this 5-year review on July 14, 2021 (86 FR 37178), and a 60-day comment period was opened. In response, we received one public comment from the National Council for Air and Stream Improvement, Inc. (NCASI) that provided information, research, and literature sources about best management practices (BMPs) that may be applied in timber operations to minimize potential impacts to aquatic habitat. Although the information provided is valuable when developing and implementing projects that include measures to minimize impacts to aquatic habitat, such as through Section 7 consultations and Section 10 permitting, the information provided was not developed specifically for the State of Louisiana in comparison to the state and species' specific BMPs currently recommended by the Service's Louisiana Ecological Services Office and Louisiana's private-public partnership of timber agencies (LFA et. al 1997). The Service has long considered the use of project-related BMPs to be valuable in conservation of species and their resources and a tool necessary for recovery of the Louisiana pearlshell; thus, we have already adequately addressed this topic using the best available science in our previous recovery documents, as well as in local Section 7 consultations and Section 10 permitting, on a case-by-case basis. However, we recognize the commentor's overarching point that ongoing improvement and increasing use of BMPs are continuing to reduce the level of forestry-related threats to aquatic habitats on private lands around the country, including aquatic habitat within the range of the Louisiana pearlshell. We have incorporated such information, as appropriate, into applicable sections of this 5-year review. Finally, the commentor wrote the document in a way that implies the species' range extends into Arkansas. We do not have adequate evidence to indicate the past or present occurrence of this species in Arkansas. Thus, as in other recent recovery documents, this 5-year review considers the Louisiana pearlshell to be historically and currently endemic to Louisiana. Designation of the historic and current species' range and population distribution are described in the SSA (Service 2019a) and the Revised Recovery Plan (Service 2019b). The entire NCASI public comment document is available at the Louisiana Ecological Services Office upon request.

Peer Review

No peer review was conducted on this 5-year review because this is the third 5-year review for this species, the level of public interest pertaining to this review is low and non-controversial, and we have not received significant new information since the prior 5-year review for the Louisiana pearlshell (Service 2017) and the SSA (Service 2019a) were written or during the 60-day comment period following the announcement of this 5-year review (86 FR 37178). However, the SSA informing this 5-year review is a peer-reviewed document that represents our evaluation of the best available scientific information regarding the biology, life history, and condition of the species.

FR Notice citation announcing the species is under active review:
July 14, 2021 (86 FR 37178)

Species' Recovery Priority Number at start of 5-year review (48 FR 43098): 8
This number indicates that a species has a moderate degree of threat and a high recovery.

Review History:
The first 5-year review for this species recommended no change in status and was published by the Service on February 22, 2011. The second 5-year review for this species recommended no change in status and was published by the Service on September 29, 2017.

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature
The Louisiana pearlshell is one of five North American mussel species in the family Margaritiferidae. Its current taxonomic classification is *Margaritifera hembeli*. There are no other species in the genus *Margaritifera* that overlap in range with this species. 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 (DPS) 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
Revised Recovery Plan for the Louisiana Pearlshell (*Margaritifera hembeli*), September 26, 2019.

Recovery plans are not regulatory documents and 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. Meeting recovery criteria can indicate that the species no longer requires protections under the Act if the recovery criteria defined in the plan are still valid. 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 Service believes the following recovery criteria/delisting criteria are appropriate and relevant; however, none of the criteria have currently been met.

Delisting Criteria:

1. At least six (6) populations exhibit a stable or increasing trend, as evidenced by natural recruitment and multiple age classes (Factors A and E).

2. At least one population (as defined in Criteria 1) occurs in each of the following management watersheds Bayou Boeuf, Bayou Rapides, Bayou Rigolette, and Black Bayou (Factors A and E).

3. Threats have been addressed and/or managed to the extent that the species will remain viable into the foreseeable future (Factors A and E).

Distribution, Biology, and Habitat Summary

Figure 1. Range and Distribution in Grant and Rapides Parishes (Service 2019a, p.34).

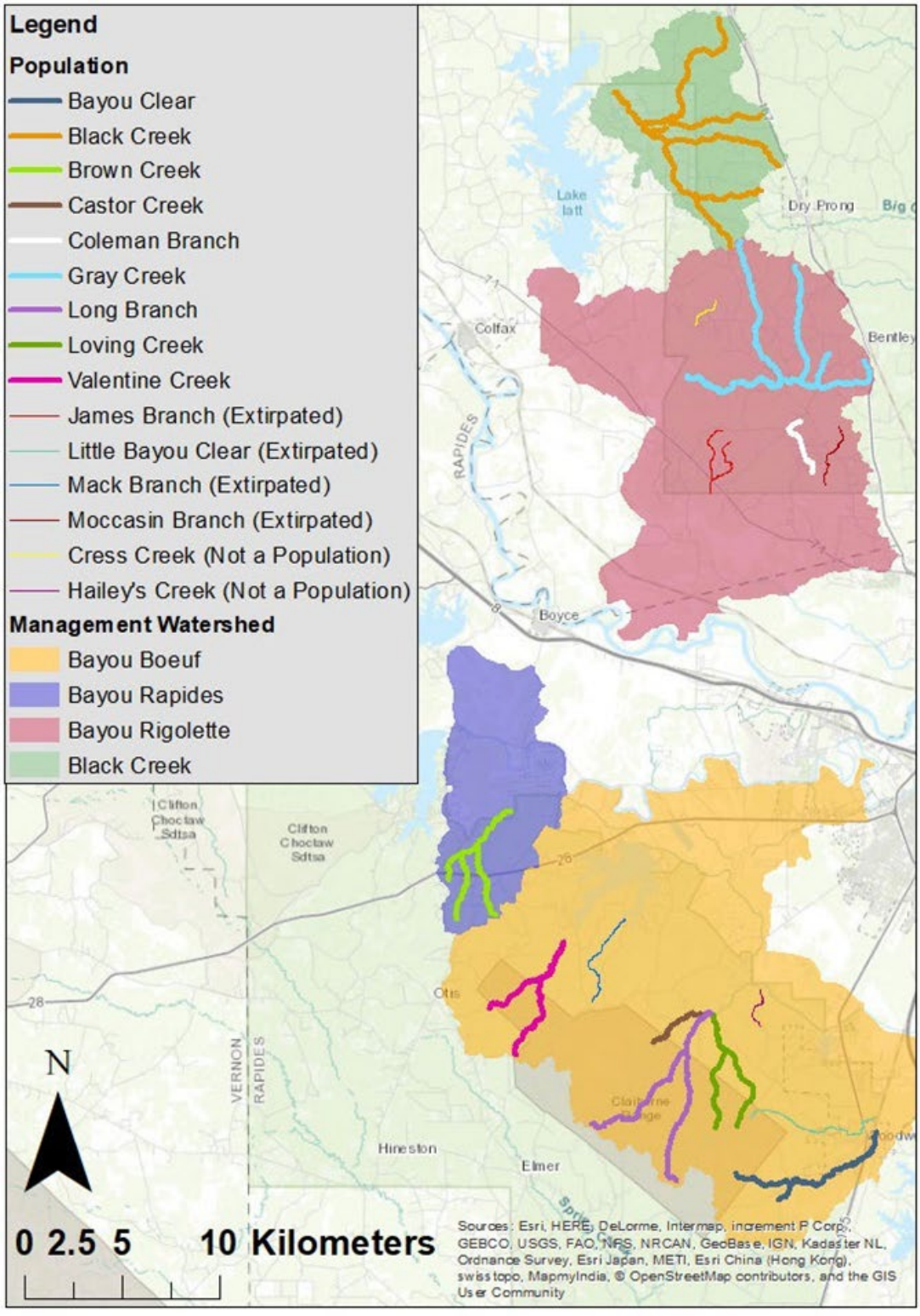

Figure 1 above shows the populations and representative units delineated for the Louisiana pearlshell. The thicker lines on the figure depict current populations, and the thinner lines represent populations that either were extirpated or that never contained high enough numbers of Louisiana pearlshell to be considered a population. A Louisiana pearlshell population is considered to have one or more mussel aggregations that contain at least100 mussels per aggregation (Service 2019a). The SSA delineated nine extant populations and four extirpated populations distributed across four management watersheds, which are Bayou Rapides and Bayou Boeuf management watersheds south of the Red River in Rapides Parish, Louisiana, and Black Creek and Bayou Rigolette management watersheds north of the Red River in Grant Parish, Louisiana (Service 2019a). Each individual management watershed is delineated within different HUC-10 watersheds by aggregating only those HUC_12 subwatersheds having Louisiana pearlshell in a way that reflects higher connectivity and potential for genetic exchange within delineated management watersheds and lower or no connectivity between them (Quantitative Ecological Services, Inc. 2014). Research into the genetic structure of the species (Garrison et. al 2021) supports our delineation methods for these four management watersheds. Populations were delineated as streams occupied by one or more Louisiana pearlshell aggregations containing at least 100 individual mussels, where multiple streams occupied by pearlshell aggregations were considered the same population only if the stream resulting from their confluence was also occupied by at least one pearlshell aggregation (Service 2019a).

Resilience for this species is the ability of Louisiana pearlshell populations to sustain in different favorable and unfavorable conditions. In the SSA (Service 2019a), resilience of Louisiana pearlshell populations was categorized as “low”, “moderate”, or “high” for each of the nine extant populations (see Table 1) by combining the condition of two population factors (i.e., composite aggregation score and evidence of reproduction) and three habitat factors (i.e., canopy cover, substrate, and stream crossings). The “aggregation score” represents both the number and size of aggregations in the population. Aggregation scores were categorized using a numerical range that corresponded with either a “low”, “medium”, or “high” category for each population. Aggregation scores were upweighted by 2.0 in the calculation for population resilience because the presence of large and multiple aggregations in a population is determined to be the highest predictor of population resilience (Service 2019a). Then each population was classified into two categories based on “evidence of reproduction”, where the “good condition” category showed evidence of reproduction in a population, and the “poor condition” category showed no evidence of reproduction in a population. Evidence of reproduction was measured by observation of juvenile recruitment. This component was down weighted to 0.5 in the calculation for population resilience because the availability and reliability of the observational data vary across the range (Service 2019a). Lastly, habitat condition was assessed using data for three habitat factors: “canopy cover” was given a weight of 1.0 in the calculation and was classified as “poor”, “moderate”, or “good” based on the weighted average of suitable canopy cover for streams; “substrate” was classified as “poor”, “moderate”, or “good” based on the percent of aggregations located on gravel substrate and was down-weighted to 0.5 in the calculation due to varying availability of these data within and among populations; and “stream crossing” was given a weight of 1.0 in the calculation and was classified as “poor”, “moderate”, or “good” based on the number of poor stream crossings per 5 km of stream length in a population. This is a simplified summary for how population resilience was assessed. Detailed methods for how population resilience was determined for this species is found on pages 38-45 of the SSA (Service 2019a).

Redundancy refers to having multiple populations which allows the species to withstand catastrophic impacts to any one population at a specific location by spreading risk across the species' range. Random catastrophic events that could severely impact entire populations include, but are not limited to, the drying of streams during drought, upstream and downstream impacts from beaver dams, and direct mortality at beaver dam sites (Service 2019a). Representation refers to the breadth of genetic and environmental diversity within and among populations that contribute to the ability of the species to respond and adapt to changing environmental conditions over time. Units of representation for the Louisiana pearlshell are the four management watersheds, which are Black Creek, Bayou Boeuf, Bayou Rapides, and Bayou Rigolette. Given that the Louisiana pearlshell is an endemic species with a historically limited range, there is a moderate degree of redundancy and representation across the species' range. See pages 49-50 of the SSA (Service 2019a) for a more detailed description of redundancy and representation in the Louisiana pearlshell.

All of the biology and habitat information provided in the SSA (Service 2019a) and last 5-year review (Service 2017) remains valid the Louisiana pearlshell, and we are not aware of any additional new biology or habitat information for the species. Please reference the SSA (Service 2019a) for detailed biological and habitat related information. Table 1 below depicts resiliency for the current species' condition.

Table 1. Summary of current resiliency for Louisiana pearlshell populations (Service 2019a).

Management Watershed	Population	Population Type[1]	Aggregation Score	Evidence of Reproduction	Canopy Cover	Substrate	Stream Crossings	Resiliency
Bayou Boeuf	Bayou Clear	Population	Good	Good	Good	Poor	Good	High
Bayou Boeuf	Castor Creek	Population	Poor	Good	Good	Good	Good	Moderate
Bayou Boeuf	Long Branch	Population	Good	Good	Good	Good	Good	High
Bayou Boeuf	Loving Creek	Population	Good	Good	Good	Moderate	Good	High
Bayou Boeuf	Valentine Creek	Population	Moderate	Good	Good	Poor	Good	Moderate
Bayou Boeuf	Little Bayou Clear	Extirpated	0	NA	NA	NA	NA	Extirpated
Bayou Boeuf	Mack Branch	Extirpated	0	NA	NA	NA	NA	Extirpated
Bayou Boeuf	Hailey's Creek	Not a Population	0	NA	NA	NA	NA	Not a Population
Bayou Rapides	Brown Creek	Population	Poor	Good	Good	Moderate	Good	Moderate
Bayou Rigolette	Coleman Branch	Population	Poor	Poor	Good	Good	Moderate	Low
Bayou Rigolette	Gray Creek	Population	Good	Good	Good	Good	Poor	High
Bayou Rigolette	James Branch	Extirpated	0	NA	NA	NA	NA	Extirpated
Bayou Rigolette	Moccasin Branch	Extirpated	0	NA	NA	NA	NA	Extirpated
Bayou Rigolette	Cress Creek	Not a Population	0	NA	NA	NA	NA	Not a Population
Black Creek	Black Creek	Population	Good	Good	Good	Good	Good	High

[1]"Population" means an area with one or more aggregations of 100 or more mussels, "Extirpated Population" once met the definition of a "Population" but has since been extirpated; and "Not a Population" means an area where low numbers of mussels have been observed, but an aggregation has never been documented.

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 at the time of listing and a summary of this assessment at the time of this 5-year review is provided below.

The greatest threats to the Louisiana pearlshell currently known include fragmented spatial distribution of populations caused by permanent impoundments that pre-date species' listing and corresponding impacts to population genetic structure; altered hydrology and disrupted spatial distribution from beaver dams and other in-stream obstructions leading to small impoundments, stranding, drowning, or crushing of mussels; declines in water quality from sediment loading, turbidity, decreased flow, lower levels of dissolved oxygen, and changes in stream geomorphology caused by improperly installed stream crossings, construction, forestry, and land use practices when there is failure to implement and maintain applicable Best Management Practices (BMPs); and all-terrain vehicle use and other recreational activity that impacts Louisiana pearlshell habitat (Factor A; Service 2019a). We expect these threats to continue into the future.

The five-factor analysis from the listing rule (58 FR 49935) named the following threats to the species: Man-made and natural impoundments reducing range and fragmenting habitat; beaver dams altering hydrology and causing localized loss of mussels; active gravel pits on private land causing sedimentation; clear-cutting up to the streambank on private lands causing erosion, runoff, sedimentation, head-cutting, and scouring streambeds (Factor A). Possibility of future recreational or scientific collection potentially reducing population size to below that needed for reproduction due to ease of observation and dense aggregation of mussels allowing ability to collect many mussels in a short time (Factor B). No known threats from disease, and no consistent pattern of predation; however, populations potentially vulnerable to predation by raccoons and muskrats due to shallow stream habitat (Factor C). No threats listed for inadequacy of existing regulatory mechanisms (Factor D). Fragmented habitat and isolated populations leading to increased risk from man-made and natural catastrophic events and creating vulnerability to decreased genetic diversity and increased susceptibility of population decline (Factor E).

Threats never present or likely ameliorated since time of listing:

- There is no evidence of disease (Factor C) or inadequacy of existing regulations (Factor D) nor was there at the time of listing.
- Sedimentation from gravel pits (Factor A) is no longer believed to be a threat. No new gravel pits are being constructed, and current evaluation indicates that the gravel pits known at the time of listing are now either inactive or located in areas where potential impacts to Louisiana pearlshell are unlikely (Service 2019a).

Threats still present but of similar or lower magnitude since the time of listing:

- Impoundments (Factor A) are permanent and have been present since before listing. This threat is ongoing, moderate, and occurs throughout the species' range. The Red River effectively separates populations found north of the river in Grant Parish from those found south of the river in Rapides Parish, but potential impacts of landscape fragmentation and population isolation on the same side of the Red River may be reduced by major flood events that allow for host fish infested by Louisiana pearlshell glochidia to move to adjacent stream channels (Garrison et.al 2001), thereby periodically adjoining some isolated populations found to the north of the Red River to each other and some populations found to the south of the Red River to each other. Management actions can potentially address impacts of impoundments, such as the recently established Louisiana pearlshell reintroduction program (Service 2020).
- Impacts of timber harvest (Factor A) have been reduced through the development of more effective best management practices (BMPs) and increasing percentages of landowners implementing BMPs within the range of the Louisiana pearlshell. This threat is ongoing, moderate, and occurs throughout the species' range on private land. Forestry BMPs are applied on a voluntary basis by private landowners; thus, this remains a potential threat throughout the range on private land. As evidence of current occurrence, a clear-cut to the streambank along a Louisiana pearlshell stream was recently documented (Louisiana Department of Wildlife and Fisheries, Whitney Nelson, personal communication, 2022). However, threat across the range on private land has been reduced due to continuing education programs for the timber community (LFS et.al 1997) and public outreach by the Service, the Louisiana Department of Wildlife and Fisheries, the U.S. Forest Service, and other partners and stakeholders.
- The potential for Louisiana pearlshell population reduction through future recreational or scientific collection (Factor B) has been reduced due to educational outreach to the public and the necessity for federal and state permitting for scientific collection of the species. Although there remains a potential threat that illegal recreational collection may occur to a level that impacts populations, there is no evidence that this has happened or is likely to happen.
- The potential of Louisiana pearlshell population reduction through predation (Factor C) remains a threat and has been rarely documented at an aggregation level (Service 2017, Service 2019a). This threat is ongoing, moderate, and occurs throughout the species' range. There is the potential that aggregation level predation may increase if streams become shallower during hotter weather and drought conditions due to increased visibility and easier access to mussel aggregations (Service 2017, Service 2019a).

Threats that are new or have increased since time of listing:

- We have identified recreational use of streams (Factor A) as a threat to the species on private land. The use of all-terrain vehicles in streams and damming up areas of the stream to create pooled water areas have been documented (Service 2017, Service 2019a, U.S. Forest Service, Steve Shively, personal communication, 2022b). These activities may lead to direct mortality through crushing by vehicles crossing the streambed or at the location of the obstruction site in the stream; injury and mortality from bank destabilization, erosion, and decreased water quality from all-terrain vehicle use;

streambed drying and stranding of mussels found upstream of obstructions; and inundation and drowning of mussels found downstream of obstructions. Observation of human recreational use in Louisiana pearlshell streams is intermittent and inconsistent across different areas of the range and is most documented on private land. Currently, the magnitude and the extent of the threat appears to be low range wide.

The threat of drought and major storm events has been increasing in recent years. The impacts of these are not yet clear on a population or species' level, but aggregations have been impacted in recent years (see Service 2017, Service 2019a). Storms with large wind events may cause stream obstruction from felled limbs and trees creating a damming effect similar to the effects of beaver dams and other in-stream obstructions. On the Kisatchie National Forest, it is possible that at least two aggregations have been affected this way, where loss of stream flow and stagnant water have contributed to declines in number of individuals in the aggregations; however, it is not yet clear if these are partially or wholly contributable to weather events or other events not yet determined (U.S. Forest Service, Steve Shively, personal communication, 2022b).

Synthesis

Louisiana pearlshell (*Margaritifera hembeli*) is a freshwater mussel endemic to Louisiana. It is a habitat specialist and is only found in shallow, oligotrophic streams with high water quality, moderate flow, a gravel substrate component, and an intact riparian zone.

The following presents the current condition of the Louisiana pearlshell, which is described in terms of "resilience", "redundancy" and "representation" as it is found in the Louisiana pearlshell species status assessment (Service 2019a). Resilience is the ability of populations to sustain under different favorable and unfavorable conditions. There are currently five Louisiana pearlshell populations with high resilience, three with moderate resilience, and one with low resilience (SSA Service 2019a). Additionally, there are four known extirpated populations (i.e., historically supported aggregations and now do not, although they might still support low numbers of scattered mussels), and two locations that are not considered to be populations (i.e., historically supported low numbers of mussels, but never supported aggregations in survey history, although they might still support low numbers of scattered mussels).

Redundancy refers to having multiple populations which allows species to withstand catastrophic impacts to any one population by spreading risk across the species' range. Random catastrophic events that could severely impact entire populations include, but are not limited to, the drying of streams during drought, and upstream and downstream impacts from beaver dams, as well as potential direct mortality at dam sites. Representation refers to the breadth of genetic and environmental diversity within and among populations that contribute to the ability of the species to respond and adapt to changing environmental conditions over time. Units of representation for the Louisiana pearlshell are four management units, Black Creek, Bayou Boeuf, Bayou Rapides, and Bayou Rigolette. There is a moderate degree of redundancy and representation across the Louisiana pearlshell range, given that the Louisiana pearlshell is an endemic species with a historically limited range.

Only one population (Black Creek, highly resilient) occurs in the Black Creek management watershed north of the Red River, but there is no evidence to suggest that any additional

populations ever existed there. Though it is highly resilient, the extent of pearlshell aggregations within the population has declined, particularly in Beaver Creek and certain segments of Black Creek.

There is also just a single population (Brown Creek, moderately resilient) in the Bayou Rapides management watershed (south of the Red River), which contains only four small Louisiana pearlshell aggregations. The Brown Creek population extent has contracted, where aggregations are not found as far upstream as they once were.

One management watershed north of the Red River and one to the south each contain a single Louisiana pearlshell population. The other two management watersheds, Bayou Rigolette to the north and Bayou Boeuf to the south, each contain multiple pearlshell populations. In Bayou Rigolette, the most robust population is Gray Creek (high resilience), which has lost some historical aggregations along the main stem of Gray Creek and some along one of its tributaries, Jordan Creek, but remains highly resilient. Other than this large population, Bayou Rigolette contains two extirpated populations, one stream that has historically supported low numbers of pearlshell mussels but never enough to be considered a population, and one population with low resilience (Coleman Branch). The Coleman Branch population supports three small aggregations, with no evidence of reproduction has been recorded during surveys, and one poor stream crossing is located less than 1 km upstream from aggregations. Given the status of the other pearlshell streams in Bayou Rigolette, Gray Creek is the only robust population within the representative unit.

The last management watershed, Bayou Boeuf, has the highest redundancy of resilient populations, supporting three populations with high resilience, two with moderate resilience, and three that were either extirpated or were never large enough to be considered populations.

Through the species status assessment process (Service 2019a), we identified that the main causes of Louisiana pearlshell habitat loss and degradation include increased levels of siltation and other pollutants in the water through various means (e.g., forestry, construction, off-road vehicle use, stream drying caused by beaver activity or drought, and fragmentation of suitable stream bed substrate and aquatic habitat from improperly installed road crossings). We expect these threats to continue into the future.

The threatened status, rather than endangered, remains warranted because the resiliency, redundancy, and representation across the species' range precludes immediate danger of extinction, even if local populations are impacted by threats at varying degrees. However, the number and level of current threats to the species preclude any recommendation to delist at this time. Therefore, a change in the classification of the Louisiana pearlshell mussel is not recommended at this time.

RECOMMENDED FUTURE ACTIVITIES

This 5-year review does not identify new recovery activities, research, monitoring, or data analysis needs because the **Revised Recovery Plan** (Service 2019b) and the **SSA report** (Service 2019a) are recent and up to date documents that present the best science currently available and identify current and potential conservation, research, and monitoring activities necessary for Louisiana pearlshell recovery. A detailed discussion of recovery actions, recovery criteria, current research and monitoring, and future research and monitoring needs are presented in the Revised Recovery Plan (Service 2019b) and the SSA (Service 2019a).

RESULTS / SIGNATURES

U.S. Fish and Wildlife Service
Status Review of Louisiana Pearlshell

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species' status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist:
____ *The species is extinct*
____ *The species does not meet the definition of an endangered or threatened species*
____ *The listed entity does not meet the statutory definition of a species*
_X___ No change needed

FIELD OFFICE APPROVAL:

Acting Field Supervisor, Louisiana Ecological Services Field Office, Fish and Wildlife Service

Approve Brigette D Firmin BRIGETTE FIRMIN Digitally signed by BRIGETTE FIRMIN Date: 2022.09.26 16:14:36 -05'00' Date 26 September 2022

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