

U. S. Fish and Wildlife Service
Revised Recovery Plan
Louisiana Pearlshell (*Margaritifera hembeli*)



Photo by Service

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For:
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Recovery plans are a non-regulatory document that provide guidance on how best to help recover species. Recovery plans delineate reasonable actions that are believed necessary to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service (Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Plans are reviewed by the public and comments are considered before they are adopted by the Service. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not obligate other parties to undertake specific tasks and do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the Service. They represent the official position of the Service only after they have been signed by the Assistant Regional Director, Regional Director, or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks. By approving this document, the Regional Director certifies that the information used in its development represents the best scientific and commercial data available at the time it was written. Copies of all documents reviewed in development of the plan are available in the administrative record, located at the Service's Southeast Regional Office, Atlanta, Georgia.

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Revised Recovery Plan for Louisiana Pearlshell (*Margaritifera hembeli*)

This Revised Recovery Plan describes criteria for determining when the Louisiana pearlshell should be considered for delisting from the Federal *List of Endangered and Threatened Wildlife* (50 CFR 17.11). It also lists actions that will be necessary to meet those criteria, and estimates the cost for implementing recovery actions. Brief descriptions of the species' status, habitat requirements, and limiting factors are included. A detailed discussion of these and other topics pertinent to the recovery of the Louisiana pearlshell can be found in the Species Status Assessment (SSA) (USFWS 2019). This supplemental document is available at <https://www.fws.gov/southeast/lafayette/>. The SSA is finalized separately from the Recovery Plan and will be updated on a routine basis.

Current Species Status: The Louisiana pearlshell (*Margaritifera hembeli*) was federally listed as an endangered species on February 5, 1988 (53 FR 3567). The Service completed the first recovery plan for the Louisiana pearlshell in December 1990 (Service 1990), at which time occurrences of Louisiana pearlshell were known only from south of the Red River in Rapides Parish, Louisiana, in the Bayou Boeuf and Bayou Rapides management watersheds. In September 1993, the species was reclassified to threatened (58 FR 49935) after the U.S. Forest Service (USFS) conducted surveys and documented that the species range extended north of the Red River in Grant Parish, Louisiana, in the Black Creek and Bayou Rigolette management watersheds. The Louisiana pearlshell remains listed as federally threatened and is assigned a recovery priority number of 8, which signifies a moderate degree of threat and a high recovery potential. The State of Louisiana has identified this mussel as a state endangered species and protects it from take and harassment (Louisiana Revised Statutes 56:1901).

The Louisiana pearlshell is an endemic species with a historically limited range very similar to its currently known range. The species' range extends across the Bayou Boeuf, Bayou Rapides, Black Creek, and Bayou Rigolette management watersheds (Quantitative Ecological Services [QES] 2014, p. 3), with the Red River serving as a significant barrier to reproductive exchange between Louisiana pearlshell to the north and south of the river. During the development of the SSA, we delineated nine extant Louisiana pearlshell populations and four extirpated populations across the range (Service 2019, p. 31-32). The nine extant populations are distributed across the Bayou Boeuf, Bayou Rapides, Black Creek, and Bayou Rigolette management watersheds, which all show some level of genetic structuring with the highest degree of genetic structuring occurring between the Louisiana pearlshells separated to the north and the south of the Red River (Garrison 2018, pers. comm.). Additionally, four populations, James Branch and Moccasin Branch (in the Bayou Rigolette management watershed) and Mack Branch and Little Bayou Clear (in the Bayou Boeuf management watershed) have been extirpated and do not presently support aggregations (Service 2019, p. 31). Of the extant populations, we found five of

the populations to have high resilience, three to have moderate resilience, and one to have low resilience. We found a moderate degree of redundancy and representation across the species' range. Section 1 of the SSA explains how we characterize the current and future status of a species based on resilience, redundancy, and representation (Service 2019, p. 1-2. These terms and how they relate to what the species' needs to maintain viability are also explained in Section 1 of the SSA (Service 2019, p. 1-2 and in the "Recovery Strategy" section of this Recovery Plan.

Habitat Requirements and Limiting Factors: Louisiana pearlshell streams are located within upland narrow stream forests of the Lower West Gulf Coastal Plain. Louisiana pearlshells usually occur in shallow water (12 to 24 inches (0.3 to 0.6 m deep; Johnson 1995, p. 10, 19 often in headwater riffles where the substrate is dominated by loose, fine, or very fine sand with infrequent patches of larger gravel substrate, and are rarely found in deep pools that have slower flowing water and silty bottoms (Johnson and Brown 1998, p. 327; Johnson and Brown 2000, p. 274; Bolden and Brown 2002, p. 94. Authors surmised this is likely due to the species' intolerance to high silt loads. No substantial variation has been found in temperature, substratum type, or water quality among study streams (Johnson 1995, p. 37; Johnson and Brown 2000, p. 273-274, but variation in mussel size has been observed and may be a function of variation in channel morphometry, current velocity, or habitat stability.

Recovery Strategy: Through the SSA process (Service 2019, entire, we have 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, grazing, 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. The recovery strategy for Louisiana pearlshell is to eliminate or minimize threats in order to promote population stability and growth to ensure the long-term viability of the species. This is contingent upon availability of funds, as well as the continued and expanded cooperation and partnership among all private, state, and federal stakeholders to effectively conserve, restore, and manage habitat for Louisiana pearlshell populations on both public and private lands.

Recovery of the Louisiana pearlshell is based upon the ecological principles of resiliency, redundancy, and representation (Wolf et al. 2015, p. 204). **Resiliency** is positively related to population size and growth and describes the ability of a species to withstand stochastic events (events arising from random factors). Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic (human-driven) activities. **Redundancy** spreads the risk among multiple populations and describes the ability of a species to withstand catastrophic events. Redundancy gauges the probability that there is a margin of safety for the species to withstand or bounce back from catastrophic events. It is measured by the number of populations, and their resiliency, distribution, and connectivity. **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more it is capable of adapting to changes in its environment.

The distribution of Louisiana pearlshell populations within their management watersheds is well documented. However, the conservation status of populations is poorly known. Population trend estimates are needed to evaluate recovery efforts, which will require continued range-wide implementation of the standardized survey and monitoring protocol (QES 2014, entire until there is sufficient data to support analysis).

Additional research is needed, such as the following: determining if fish passage is adequate to ensure the ability of the host fish to access glochidia during key reproductive times and to carry those glochidia to other areas to support genetic exchange among populations; continued investigation of controlled propagation and reintroduction of Louisiana pearlshells to determine whether this approach could restore populations lost to catastrophes or to add new populations to increase redundancy; investigate genetic structuring across populations within management watersheds as needed to implement conservation; investigate ways to restore degraded habitat (e.g., crossing replacement, riparian restoration, beaver dam removal, etc. to increase available suitable habitat and connectivity among populations; investigate expected resiliency of Louisiana pearlshell habitat to future drought to identify which streams are the most and the least susceptible to drying during catastrophic drought; investigate the utility of consolidating scattered Louisiana pearlshells into aggregations; and other research not named here.

These research efforts will allow for best estimates of future viability of recovered populations. Protection of populations will require collaboration with key stakeholders. Coordination is needed between appropriate federal and state agencies, as well as private landowners, to maintain and improve habitat by protecting riparian buffers and replacing road crossings at critical locations, when needed, to restore hydrology, water flow, and water quality; controlling nuisance species that lead to loss of Louisiana pearlshell individuals and habitat; targeting expansion of populations to streams within the current species' range that are thought to be highly resilient to drought; and ensuring that development incorporates best management practices that are protective of Louisiana pearlshell and their habitat (Service 2019, p. 16-28).

Recovery Objectives: We review five factors (Factors A through E) to assess achievement in eliminating or reducing threats to meet species' recovery objectives (Service 2019, p. 16-28). The recovery objectives are to protect, restore, and manage habitat to provide conditions necessary to recover and ultimately remove the Louisiana pearlshell from the list of protected species under the Endangered Species Act. We are defining reasonable recovery criteria for what constitutes a recovered species based on the best available information for the Louisiana pearlshell. As new information becomes available, criteria will be reevaluated and updated accordingly.

Recovery Criteria:

Criteria for Delisting:

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).

Justification for Delisting Recovery Criteria

Criteria 1 and 2: Genetic work (Roe 2009, p. 11 indicates that there are degrees of isolation among populations and management watersheds, with several individual populations that are small and fragmented. Evidence suggests that impacts and predicted future impacts to the species number, local abundance, and distribution correspond to habitat degradation resulting from cumulative effects of land use change and watershed level effects on water quality, water quantity, habitat connectivity, and instream habitat quality. Recovery Criterion 1 maximizes resiliency by ensuring presence of multiple age classes, including juveniles, and sufficient number of individuals to sustain population resilience. Recovery Criteria 1 and 2 ensure redundancy by specifying the number of resilient populations and proportion of the range occupied necessary to delist the species.

Surveys of Louisiana pearlshells have been conducted since before the species was listed and have allowed an accurate delineation of populations and their spatial distribution. Sustaining the spatial distribution of the species distributed throughout each management watershed protects against catastrophic or stochastic events that may eliminate or substantially reduce isolated or fragmented populations. Ensuring that populations are distributed throughout the range (e.g., multiple streams) in addition to within each stream (e.g., multiple aggregations) addresses resiliency (proportion of habitat occupied and redundancy (spatial distribution within streams and across management watersheds. Although we know there has been genetic structuring, particularly between populations located on the north and south sides of the Red River (Garrison 2018, pers. comm.), these recovery criteria assume genetic variation exists between populations within management watersheds where there is adequate connectivity for host fish movement between populations. In order to retain genetic variability, recruitment between populations must occur, either naturally or with assistance from humans, where populations have been isolated due to anthropogenic influence. By ensuring sufficient number of resilient populations distributed across the species range, we address representation in order to maintain adaptive potential through preserving genetic and ecological diversity.

Criterion 3: The main threat to the Louisiana pearlshell continues to be habitat loss and degradation resulting from a variety of land uses. Consequently, populations from historically occupied sites are extirpated or have suffered a decline in abundance. The life history traits and habitat requirements of the Louisiana pearlshell, and other freshwater mussels in general, make them extremely susceptible to water quality variables and environmental change. Unlike other aquatic organisms (e.g., aquatic insects and fish, mussels are limited in mobility to escape or seek refuge from habitat disturbance (e.g., droughts, sedimentation, chemical contaminants. The synergistic (interaction of two or more components effects of threats are often complex in aquatic environments, making it difficult to predict changes in mussel and fish host(s) distribution,

abundance, and habitat availability that may result from these effects. The Service will continue to evaluate these threats on the species and its habitat.

Actions Needed: The recovery actions identified in the table below are those that, based on the best available science, we believe are necessary to accomplish the recovery of the Louisiana pearlshell.

Table 1. Recovery Actions with Estimated Cost and Priority Number¹

Recovery Action	Estimated Cost	Priority
Improve range-wide protections for riparian areas and water quality.	\$100,000	2
Identify and address threats to populations and species to conserve and restore habitat for the preservation and growth of the species.	\$750,000	2
Implement propagation and reintroduction program, if necessary, to repopulate key areas affected by catastrophes or to expand population distribution.	\$250,000	2
Implement population and habitat surveys using standardized protocols, as part of a range-wide monitoring plan.	\$350,000	3
Conduct analysis to determine range-wide population and habitat trends using data collected through standardized methods for monitoring of populations and habitat conditions.	\$50,000	3
Continue genetic analysis to determine the discreteness between and among populations to estimate genetic viability and apply results toward species conservation.	\$90,000	3
Continue to conduct research to develop a more complete understanding of biological and ecological factors that are affecting the species.	\$90,000	3
Periodically review recovery progress and strategy Coordinate all recovery activities, evaluate success, and update recovery documents as needed.	\$75,000	3
Total Estimated Cost: \$1,755,000		

Recovery actions are assigned numerical priorities to highlight the relative contribution they may make toward species recovery (48 FR 43098):

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2 – An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 – All other actions necessary to provide for full recovery of the species.

Estimated Cost to Delist: The cost to recover and ultimately delist Louisiana pearlshell is estimated to \$1,755,000. Some costs are not determinable at this time and therefore the total cost of recovery may be higher than this estimate. Additionally, some costs are difficult to accurately estimate which could lead to an increase or a decrease in total cost.

Date of Delisting: If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, we anticipate that recovery criteria for delisting could be met by 2026.

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