

Recovery Plan for the Canoe Creek Clubshell (*Pleurobema athearni*)



Photo of museum specimen of Canoe Creek clubshell by Dr. Paul Johnson, Alabama Aquatic Biodiversity Center.

U.S. Fish and Wildlife Service
Southeast Region
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PURPOSE AND DISCLAIMER

This document presents the U.S. Fish and Wildlife Service's (Service) plan for the conservation of Canoe Creek clubshell (*Pleurobema athearni*). The recovery plan is the second part of the Service's three-part recovery planning framework and includes the statutorily required elements pursuant to section 4(f) of the Endangered Species Act (Act) of 1973, as amended (U.S.C. 1531 *et seq.*). This recovery plan is informed by the first part of the framework, a species status assessment (SSA) report (Service 2020, entire), which provides foundational science for informing decisions related to the Act. The SSA report includes an analysis of the best available scientific and commercial information regarding a species' life history, biology, and current and future conditions that characterizes the species' viability or its ability to sustain populations in the wild over time and characterizes its extinction risk. We have also prepared a recovery implementation strategy (RIS), the third part of the framework (Service 2025, entire). The RIS is a separate, updateable document that details the on-the-ground recovery activities needed to complete the recovery actions contained in the recovery plan.

Recovery plans describe the envisioned recovered state for a listed species or when it should no longer meet the Act's definitions of a threatened or endangered species. They also include a recovery strategy, recovery criteria, recovery actions, and the estimates of time and cost needed for a species to achieve these conditions and be considered successfully recovered. Plans are published by the Service and are often prepared with the assistance of recovery teams, contractors, State agencies, and other partners. Recovery plans do not necessarily represent the views, official positions, or approval of any individuals or agencies involved in plan formulation, other than the Service. They represent the official position of the Service only after they have been approved and signed by the Regional Director. Recovery plans are guiding and planning documents only. Identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements. Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year, in contravention of the Anti-Deficiency Act (31 U.S.C. 1341), or in violation of any other law or regulation. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and completion of recovery actions. Copies of all documents reviewed in development of the plan are available in the administrative record located at the Service's Alabama Ecological Services Field Office in Daphne, Alabama.

Approved: *for* _____

Regional Director, Region 4, U.S. Fish and Wildlife Service

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RECOMMENDED CITATION AND ELECTRONIC AVAILABILITY

U.S. Fish and Wildlife Service (Service). 2025. Recovery Plan for Canoe Creek Clubshell (*Pleurobema athearni*). U.S. Fish and Wildlife Service, Region 4, Atlanta, Georgia. 11 pp.

This document will be made available online at <https://ecos.fws.gov/ecp/species/4693> and at <https://www.fws.gov/species/canoe-creek-clubshell-pleurobema-athearni>.

Recovery Plan for the Canoe Creek Clubshell (*Pleurobema athearni*)

INTRODUCTION

This recovery plan describes criteria for determining when the Canoe Creek clubshell should be considered for delisting, lists site-specific actions that will be necessary to meet those criteria, and estimates the time and cost to achieve recovery. Additionally, a summary of information on the species' biology and status are included, along with a brief discussion of factors limiting its populations. More information about the Canoe Creek clubshell can be found in the SSA report (Service 2020). Detailed on-the-ground activities needed to implement recovery actions can be found in the RIS (Service 2025). These supplemental documents will be finalized separately from the recovery plan and will be available at <https://ecos.fws.gov/ecp/species/4693> and at <https://www.fws.gov/species/canoe-creek-clubshell-pleurobema-athearni>.

SPECIES STATUS

The Canoe Creek clubshell was listed as endangered on August 5, 2022 (87 FR 40115). Approximately 58.5 river kilometers (rkm) (36.5 river miles (rmi)) of critical habitat have been designated in the Big Canoe Creek watershed in St. Clair and Etowah Counties, Alabama, including the Little Canoe Creek (East) and Big Canoe Creek/Little Canoe Creek (West) units (87 FR 40128). Both designated critical habitat units were occupied at the time of listing (87 FR 40128). This species has been assigned a recovery priority number of 5, which indicates a high degree of threat with low recovery potential. The degree of threat is considered high because this species is a rare, narrow endemic to the Big Canoe Creek watershed in north-central Alabama, and its viability is reduced from effects of past and ongoing stressors, including sedimentation, declining water quality, and extreme weather events such as droughts and floods (87 FR 40119–40120; Service 2020, pp. 30–45; Service 2023, p. 2). Recovery potential is considered low because the mussel's reproductive strategy makes it vulnerable to negative effects associated with increased frequency of severe weather events, as well as loss of habitat connectivity and other ongoing habitat stressors.

The Canoe Creek clubshell occurs as two isolated subpopulations in the Big Canoe Creek watershed, which drains into the Coosa River. The western subpopulation occupies approximately 32 kilometers (km) (20 miles (mi)) of habitat in mainstem Big Canoe Creek and 15 km (9 mi) of Little Canoe Creek (West) and the eastern subpopulation occupies approximately 5 km (3.1 mi) of Little Canoe Creek (East) (Figure 1; Service 2020, pp. 16–17, 27–29). The limited recruitment success and lack of young age classes observed in populations of this species reduces its ability to recover from a severe stochastic event and lowers its resiliency. This species is a narrow endemic with no data to suggest that it ever occurred outside of the Big Canoe Creek watershed. Therefore, its current representation is likely similar to its historical representation because of its distribution in one watershed and an inferred lack of genetic diversity and exchange between two subpopulations, which limits its adaptive capacity. Redundancy of the species is considered low since its range is narrow, and both subpopulations could be negatively affected during a catastrophic event, such as a severe drought (Service 2020, pp. 54–55; Service 2023, pp. 2–4).

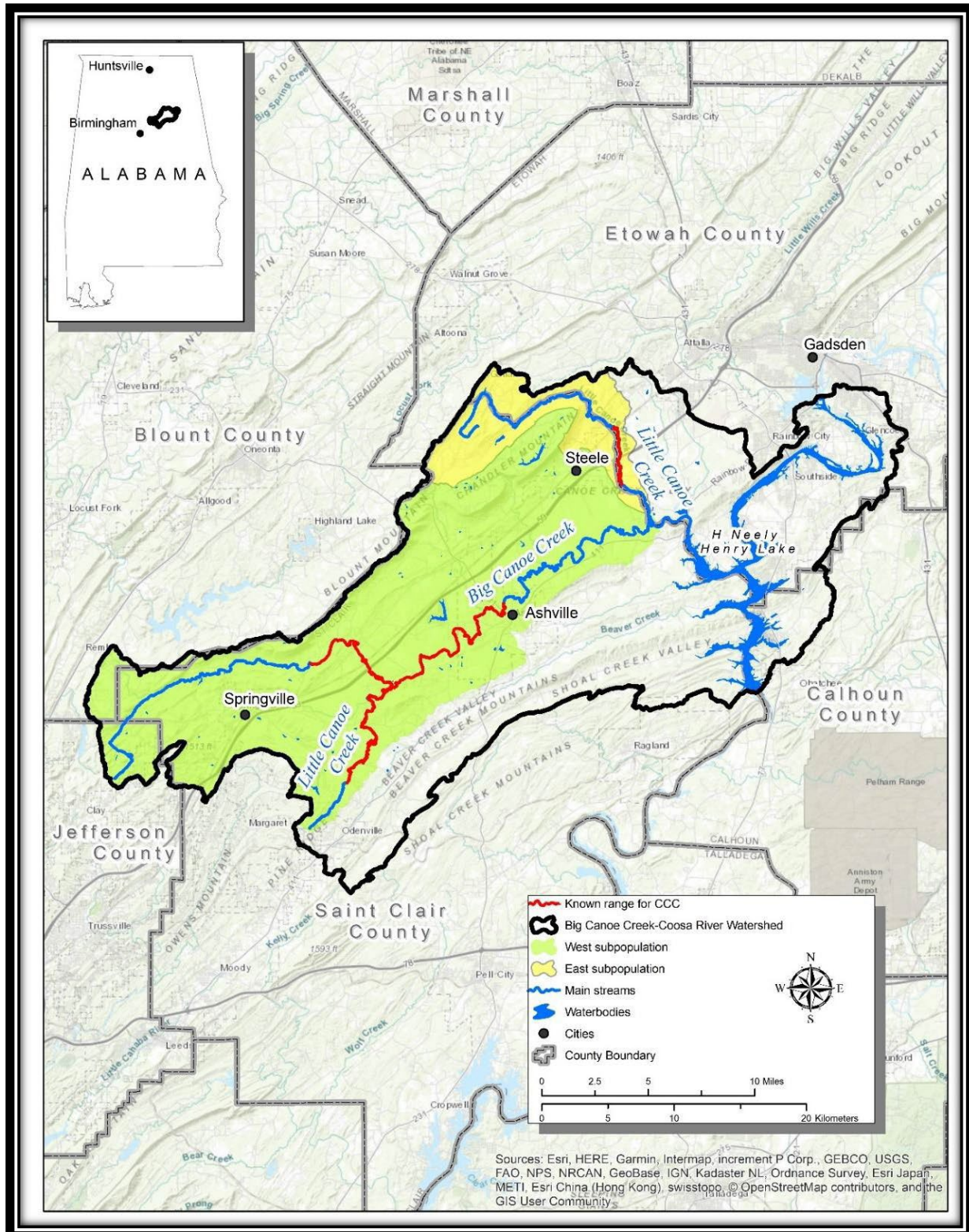


Figure 1. Canoe Creek clubshell subpopulation ranges within Big Canoe Creek watershed (HUC-10). The Big Canoe Creek-Little Canoe Creek West (West) subpopulation is highlighted in green, and the Little Canoe East (East) subpopulation is highlighted in yellow (Service 2020, p. 19).

SPECIES NEEDS AND LIMITING FACTORS

The Canoe Creek clubshell is a medium-sized mussel up to 97 millimeters (mm) (3.8 inches (in)) in length, with a moderately thick ovate to subovate shell, tawny to brown in color, and without rays (Service 2020, p. 15). This species is found primarily in shoal habitat in the Big Canoe Creek watershed in St. Clair and Etowah counties, Alabama. It prefers clean gravel substrates, free from excessive fine sediments. It is likely a long-lived and slow-growing species with an average life expectancy estimated at 25 to 35 years and a maximum life expectancy of 50 years (Service 2020, p. 20). Sexual maturity for individuals likely occurs between the fourth and fifth growth seasons or when they reach 42–55 mm in size. The Canoe Creek clubshell is a short-term brooder and is gravid in the spring and summer. The tricolor shiner (*Cyprinella trichroistia*) and the Alabama shiner (*Cyprinella callistia*) have both been identified as primary fish hosts. Gravid females release conglomerates, or lanceolate-shaped packets of glochidia, into the water column to target these minnow species for reproduction (Service 2020, pp. 15–16, 21–22). More information on taxonomy, life history, range and distribution, and species description can be found in the SSA report (Service 2020, pp. 14–24).

In addition to the habitat requirements described above, designated critical habitat for the Canoe Creek clubshell includes the following physical or biological features as essential to the species' conservation (87 FR 40135):

- Suitable substrates and connected instream habitats, characterized by a geomorphically stable stream channel (a channel that maintains its lateral dimensions, longitudinal profile, and spatial pattern over time without aggrading or degrading bed elevation) and connected instream habitats (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).
- A hydrologic flow regime (*i.e.*, the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species is found; to maintain connectivity of streams with the floodplain; and to provide for normal behavior, growth, and survival of all life stages of Canoe Creek clubshell mussels and their fish hosts.
- Water quality (including, but not limited to, temperature, conductivity, hardness, turbidity, ammonia, heavy metals, oxygen content, and other chemical characteristics) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages of Canoe Creek clubshell mussels and their fish hosts.
- Sediment quality (including, but not limited to, coarse sand and/or gravel substrates with low to moderate amounts of fine sediment, low amounts of attached filamentous algae, and other physical and chemical characteristics) necessary for normal behavior, growth, and viability of all life stages of Canoe Creek clubshell mussels and their fish hosts.
- The presence and abundance of fish hosts, which may include the tricolor shiner (*Cyprinella trichroistia*), Alabama shiner (*Cyprinella callistia*), and striped shiner (*Luxilus chrysocephalus*), necessary for the recruitment of the Canoe Creek clubshell mussel.

Several stressors are contributing to the status of the Canoe Creek clubshell (Service 2020, pp. 30–45; Service 2023, p. 2). Specifically, increased sedimentation and declining water quality attributed to various land use activities within the Big Canoe Creek watershed and inundation

due to impoundments on the Coosa River have rendered some stream reaches unable to support the species. In addition, an increase in the frequency of severe droughts observed in the recent past and projected to occur in the future is anticipated to have substantial effects on this narrow endemic species. Finally, limited recruitment success as evidenced by a lack of small age classes observed in the population indicates that this species will be unable to rebound from these stressors (Service 2020, pp. 30–45).

RECOVERY STRATEGY

The recovery strategy provides a concise overview of the envisioned recovered state for Canoe Creek clubshell, describes the Service's chosen approach to achieve it, and includes the rationale for why the approach was chosen. Specifically, the recovery strategy articulates how the plan's statutory elements, including the recovery criteria, recovery actions, and estimates of time and cost, will work together to achieve Canoe Creek clubshell's recovery.

The overall recovery strategy for Canoe Creek clubshell is to improve the number and distribution of healthy, resilient subpopulations of the species throughout its range within the Big Canoe Creek watershed, to protect and restore its habitat, and to alleviate threats to the species so these efforts will be successful. Healthy subpopulations will inhabit multiple gravel shoals in proximity, which will facilitate genetic exchange through movement of fish hosts and allow stream reaches to be recolonized and better recover from both stochastic and catastrophic events. A non-linear distribution of healthy subpopulations in the network of tributary and mainstem streams with suitable habitat will also protect against the negative effects of stochastic events. Each subpopulation will also contain a sufficient density of adults for reproduction, multiple age classes, and evidence of successful recruitment of juveniles. It is essential that we improve our understanding of the needs of Canoe Creek clubshell individuals and subpopulations and their responses to stressors and threats, including the extremely low observed survival and recruitment rates of juveniles, to help guide implementation of specific recovery actions and activities. In addition to population genetics research, routine monitoring of existing subpopulations, researching the habitat and water quality needs of individuals in relation to threats, and monitoring outcomes of continued controlled propagation, population augmentation, and reintroduction efforts will provide information necessary for the recovery of the species.

Freshwater mussels are reliant on common public waters subjected to many inputs mediated by human activity and natural events. Efforts to reduce threats, such as sedimentation; nonpoint source pollution from adjacent land use activities including silviculture, agriculture, and urbanization; in-water activities including dredging; point source pollution including effluent discharges; and loss of connectivity from stream barriers (87 FR 40119–40121), will be critical to restore habitat and protect the Canoe Creek clubshell. We expect the recovery of Canoe Creek clubshell to require long-term human intervention to alleviate threats, strengthen existing subpopulations, and establish new subpopulations. Planning and implementation of conservation activities to recover Canoe Creek clubshell efficiently and effectively will require a watershed-level approach and close coordination and collaboration with partners and other interested parties, including municipal, state, and federal agencies, land conservancies, landowners, universities, and industry professionals.

RECOVERY CRITERIA

Recovery criteria are statutorily required objective, measurable descriptions of the recovered state for Canoe Creek clubshell, as described in 4(f)(1)(b)(ii) of the Act. Recovery criteria describe the conditions of resiliency, redundancy, representation, and threat abatement that, when met collectively, indicate Canoe Creek clubshell may no longer meet the Act's definitions of a threatened or endangered species and may be removed from the Federal Lists of Endangered and Threatened Wildlife and Plants (50 CFR 17.11).

The Service may list, downlist, or delist a species based on the five factors described in section 4(a)(1) of the Act, including:

- (A) the present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) overutilization for commercial, recreational, scientific, or educational purposes;
- (C) disease or predation;
- (D) the inadequacy of existing regulatory mechanisms;
- (E) other natural or manmade factors affecting its continued existence.

The following recovery criteria reflect the best available scientific and commercial information for Canoe Creek clubshell and present our best estimate of the species' recovered condition at the time of development of this document. They also address the five factors in the Act (listed above), including those identified in the final listing rule for Canoe Creek clubshell (Table 1; 87 FR 40115–40124). Changes in available information, technologies, and our understanding of the species over time might mean that the recovered state envisioned by the recovery criteria differs from our assessment in a later status determination. As new information becomes available, criteria will be re-evaluated and updated accordingly.

Table 1. Summary of threats, criteria, and actions.

4(a)(1) Factor	Threat	Recovery Criteria	Recovery Actions
A	Sedimentation	1, 2	1, 3, 5
A, D	Water Quality	1, 2	1, 3, 5
A, E	Severe Weather Events	1	2, 3, 4

Criterion 1

Multiple subpopulations of the Canoe Creek clubshell should be distributed throughout the available network of stream habitat in the Big Canoe Creek watershed to reduce the threat of a singular, catastrophic mortality event. These subpopulations should demonstrate stable or increasing abundance trends, natural recruitment, and age class distributions indicative of healthy, resilient subpopulations over a 50-year period.

Justification for Criterion 1

Fifty years represents a period of two complete lifespans of an individual Canoe Creek clubshell and a period of approximately 10 reproductive generations or the time needed for a juvenile to mature into an adult and reproduce. The survival rate of glochidia to the adult life stage is extremely low, and recruitment rates can vary (Service 2020, pp. 21–23). These life history characteristics, in conjunction with little observed natural recruitment, indicate an extended period will likely be needed to re-establish or reintroduce subpopulations and to document successful reproduction and recruitment of Canoe Creek clubshell.

Healthy, resilient subpopulations should inhabit multiple gravel shoals in proximity, which will facilitate genetic exchange through movement of fish hosts and allow stream reaches to be recolonized and better recover from both stochastic and catastrophic events. Each subpopulation will also contain a sufficient density of adults for reproduction, multiple age classes, and evidence of successful recruitment of juveniles. Resilient subpopulations provide adaptive capacity for the species and sources for conservation and recovery efforts, such as captive propagation, to benefit other less resilient subpopulations. Subpopulations must also exhibit successful reproduction and recruitment to maintain viability over time. Ensuring that subpopulations have a non-linear distribution in multiple streams within the Big Canoe Creek watershed will increase the redundancy and adaptive capacity of populations to respond to changing environmental conditions and unexpected mortality events.

Criterion 2

Threats, including but not limited to those identified in the listing rule (87 FR 40115–40124) and SSA report (Service 2020, pp. 30–45), within the Big Canoe Creek watershed have been addressed and managed to the extent that water quality, water quantity, instream habitat, habitat connectivity, and host fish communities will be maintained at levels that meet life history requirements of the Canoe Creek clubshell and detrimental effects occur at levels that minimize effects on subpopulation resilience. Additionally, reasonable assurances have been secured that mechanisms are in place to prevent a resurgence of existing threats or emergence of foreseeable threats to the species and its habitat.

Justification for Criterion 2

Sedimentation, declining water quality, and effects from severe weather events, such as floods or droughts, are considered ongoing stressors or threats to the persistence and viability of Canoe Creek clubshell (87 FR 40115–40124; Service 2020, pp. 30–45). Management or abatement of these and other identified threats across the Big Canoe Creek watershed must be achieved to meet life history requirements, achieve recovery, and delist the species. Available habitat for the Canoe Creek clubshell throughout the Big Canoe Creek watershed and its subwatersheds, including Lower Big Canoe Creek, Little Canoe Creek (east), Gulf Creek, Muckleroy Creek, Middle Big Canoe Creek, Pinedale Lake, Dry Creek, Little Canoe Creek (west), and Upper Big Canoe Creek (Service 2020, p. 34), should exhibit the essential physical or biological features outlined in the critical habitat rule (87 FR 40135, Service 2020, pp. 16–19, 24–27). Successful

habitat restoration and other conservation efforts will require long-term efforts throughout the Big Canoe Creek watershed over a 50-year period in collaboration with partners.

RECOVERY ACTIONS

Recovery actions are the statutorily required, site-specific management actions needed to achieve recovery criteria, as described in section 4(f)(1)(B)(i) of the Act. The Service assigns recovery action priority numbers (1-3) to rank recovery actions. The assignment of priorities does not imply that some recovery actions are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented. The recovery actions identified below are those that, based on the best available scientific and commercial information, are necessary to recover the Canoe Creek clubshell (Table 2). Specific activities for each action are expanded upon in the RIS (Service 2025, entire).

Table 2. Recovery action summary.

Related Recovery Criterion	Recovery Action ID Number	Recovery Action	Estimated Cost ¹	Priority ²
1, 2	1	Maintain, enhance, restore, and protect habitat by using voluntary best management practices, bank stabilization, riparian buffer restoration, barrier removal, conservation easements, and land acquisition in the Big Canoe Creek watershed to protect extant subpopulations and reduce threats.	\$14,075,000	1
1	2	Develop a controlled propagation plan for the species, continue to evaluate genetic structure and diversity of subpopulations, and continue controlled propagation efforts to support augmentation and reintroduction of subpopulations.	\$2,500,000	1
1, 2	3	Increase knowledge of the biology and ecology of the species, particularly the needs of individuals and populations and their responses to threats.	\$1,500,000	1
1	4	Develop and implement a long-term population, habitat, and fish host monitoring program, consistently monitor the status of existing and reintroduced populations, and search for undocumented occurrences of the species within its current and historical range.	\$1,720,000	2
2	5	Coordinate with and empower local, state, and federal partners to reduce sources of pollutants, to promote watershed	\$750,000	2

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		stewardship, and to conduct outreach in local communities.		
		Total Estimated Cost:	\$20,545,000	

¹Costs covered under existing programs are not included in this table.

²Priority 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 and/or habitat quality, or some other significant negative effect short of extinction.

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

ESTIMATED TIME AND COSTS TO ACHIEVE RECOVERY

Estimates of time and cost, as defined in section 4(f)(1)(B)(iii) of the Act, must reflect, to the maximum extent practicable, the total amount of time and costs it will take to achieve the recovery or delisting of Canoe Creek clubshell. The cost estimates provided do not account for possible future inflation. Some costs specified may also be shared with recovery programs for other federally listed species and will benefit other species in the Big Canoe Creek watershed. We estimate that the full implementation of the recovery actions would improve the status of Canoe Creek clubshell so that it could be delisted within 50 years following the adoption of this recovery plan. We also estimate the total cost of recovery at \$20,545,000 dollars. We note that the recovery program may change over time, or the timeframe estimated to implement the recovery actions to achieve recovery of the species may take longer than expected. The recovery of Canoe Creek clubshell will depend largely on the commitment and the ability of the Service and our partners to implement the recovery actions necessary to achieve the recovery criteria.

LITERATURE CITED

- U.S. Fish and Wildlife Service (Service). 2020. Species Status Assessment Report for the Canoe Creek Clubshell (*Pleurobema athearni*), Version 1.1. February 2020. Atlanta, Georgia. 106 pp.
- U.S. Fish and Wildlife Service (Service). 2022. Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Canoe Creek Clubshell and Designation of Critical Habitat. Federal Register 87(128): 40115-40138.
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- U.S. Fish and Wildlife Service (Service). 2025. Recovery Implementation Strategy for Canoe Creek Clubshell (*Pleurobema athearni*). Atlanta, Georgia. 15 pp.