Draft Recovery Plan for the Spring Pygmy Sunfish (*Elassoma alabamae*)

Photo of adult spring pygmy sunfish by Evan Collins, USFWS.

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 spring pygmy sunfish (*Elassoma alabamae*). The recovery plan 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*.). We have also prepared a recovery implementation strategy (RIS). 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.

ACKNOWLEDGMENTS

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RECOMMENDED CITATION AND ELECTRONIC AVAILABILITY

U.S. Fish and Wildlife Service (Service). 2026. Draft Recovery Plan for the Spring Pygmy Sunfish (*Elassoma alabamae*). U.S. Fish and Wildlife Service, Region 4, Atlanta, Georgia. 14 pp.

This document will be made available online at https://ecos.fws.gov/ecp/species/652 and at https://www.fws.gov/species/spring-pygmy-sunfish-elassoma-alabamae.

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INTRODUCTION

This recovery plan describes criteria for determining when the spring pygmy sunfish should be considered for delisting, identifies site-specific actions that will be necessary to meet the criteria, and estimates the time required and costs for implementing actions necessary to achieve recovery. Additionally, a summary of information on the species' biology and status are included, along with a brief discussion of factors limiting populations. More information about the spring pygmy sunfish can be found in the listing and critical habitat rules, 5-year reviews, and SSA report. Detailed on-the-ground activities needed to implement recovery actions can be found in the recovery implementation strategy (RIS), which will be finalized separately from the recovery plan and updated on a routine basis. These supplemental documents are available at https://ecos.fws.gov/ecp/species/652 and at https://www.fws.gov/species/spring-pygmy-sunfish-elassoma-alabamae.

SPECIES STATUS

The spring pygmy sunfish was federally listed as threatened on December 2, 2013 (Service 2013). Critical habitat was designated for this species on July 1, 2019 (Service 2019) and includes approximately 5.2 stream kilometers (skm) (3.2 stream miles (smi)) in the Beaverdam Spring/Creek, 3.4 skm (2.1 smi) in the Pryor Spring/Branch, and 2.3 skm (1.4 smi) in the Blackwell Swamp/Run units (Service 2019). The Pryor Spring/Branch unit was not occupied at the time of listing (Service 2019) and currently remains unoccupied (Service 2024).

The spring pygmy sunfish exhibits metapopulation dynamics within the Beaverdam Spring/Creek Complex in Limestone County, Alabama (Sandel 2008; Sandel 2011), and genetic analyses indicate two populations constitute this metapopulation (Pounders 2024). One population is comprised of most known occupied sites in the Beaverdam Creek watershed, including Beaverdam Spring Head, Moss Pond/Spring, Lowe Ditch, Beaverdam Swamp, Beaverdam Creek at Ford, Ragland Spring, Beaverdam Creek Old Hwy 20 Bridge, and Beaverdam Creek at I-565 Site. The second population includes Thorsen Spring (Pounders 2024), and additional sampling is necessary to define the extent of this population. The species also occurs as a single, panmictic or randomly breeding population in Blackwell Swamp in Madison County, Alabama (Figure 1; Service 2013). Both spring systems are within the Tennessee River watershed. The Beaverdam Spring/Creek Complex metapopulation and Blackwell Swamp population are isolated from one another by the Tennessee River (Figure 1).

Historically, additional populations of the spring pygmy sunfish were known from Cave Springs in Lauderdale County, Alabama, and Pryor Spring within the Swan Creek watershed in Limestone County, Alabama; however, these populations are currently considered extirpated (Service 2013; Service 2024). This reduction in total populations and distribution across the species' historically known range translates to a reduction in redundancy or its ability to recover from catastrophic events, such as severe drought.

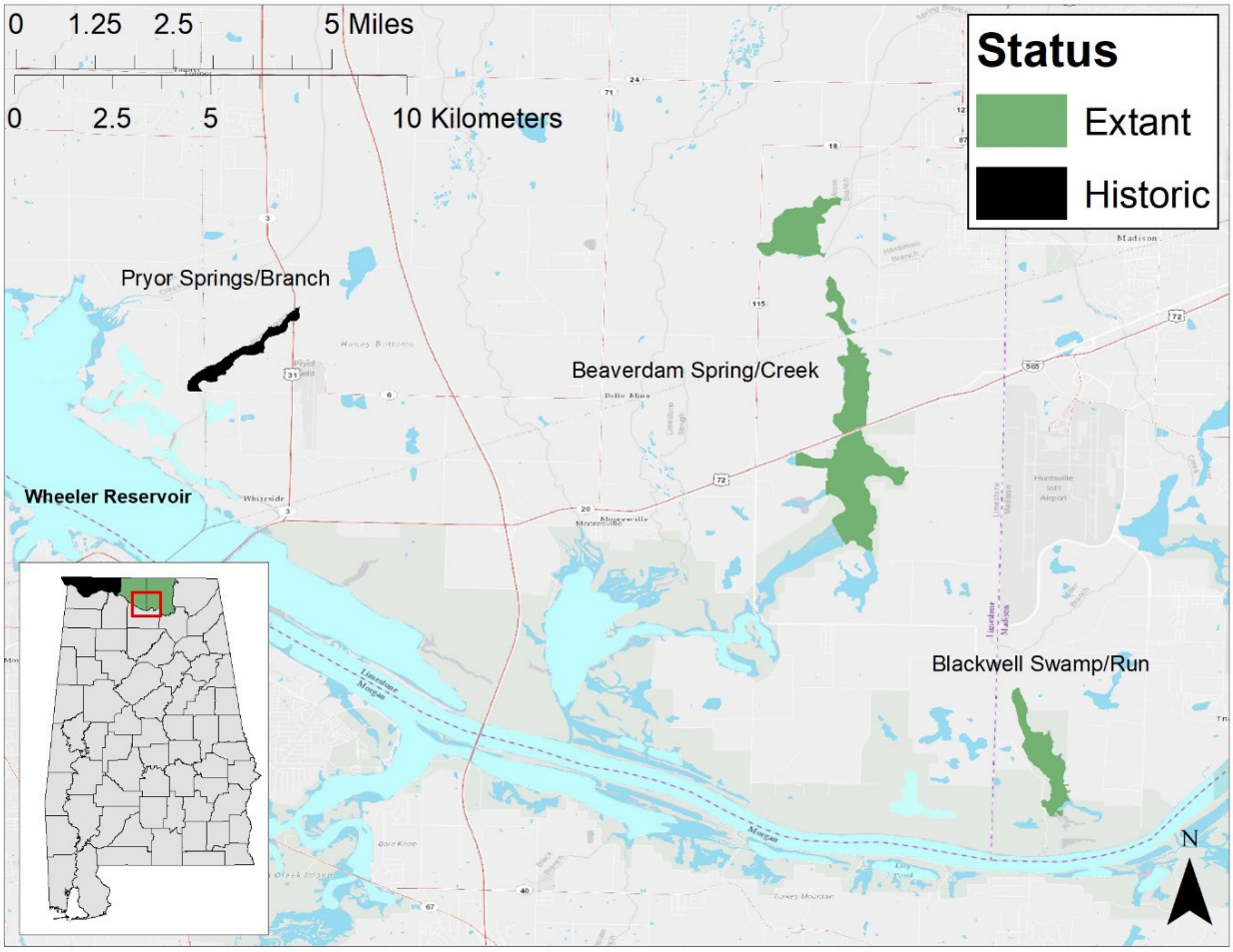

Figure 1. Current and historical distribution of the spring pygmy sunfish in Limestone and Madison Counties, Alabama. The Beaverdam Spring/Creek Complex and Blackwell Swamp/Run populations are extant and denoted in green, while the Pryor Springs/Branch population is extirpated and denoted in black (Service 2024).

This species is endemic to springs along the northern bank of the Tennessee River within Alabama, where it remains. Its current and historic representation are likely similar. The species' dependence on spring habitats, which are known for stable water quality and quantity, within a narrow range also limits its adaptive capacity.

Populations of the spring pygmy sunfish are monitored annually by recording catch per unit effort (CPUE) (Service 2024). The Beaverdam Spring/Creek Complex metapopulation exhibits resiliency primarily through high CPUE and numerous occupied sites (Service 2024). The Blackwell Swamp population exhibits resiliency primarily through consistent CPUE values (Service 2024). Habitat quality also affects the resiliency of populations, particularly those within metapopulations that depend on gene flow and recolonization dynamics to remain extant (Service 2024).

SPECIES NEEDS AND LIMITING FACTORS

The spring pygmy sunfish is the smallest member of the genus *Elassoma* (Service 2012). The species is sexually dimorphic, and breeding males are very dark to black in color with iridescent blue-green bars on their sides, while females are brown with a cream to white ventral region or belly. The average standard length, or the distance from the tip of the snout to the end of the last vertebrate, for both sexes is less than 25.4 millimeters (mm) (1 inch (in)) with males generally being smaller than females (Service 2012). The spring pygmy sunfish has an average life span of one year or less (Service 2012). Adults spawn when water temperatures are approximately 14-20 degrees Celsius (°C) (57-68 degrees Fahrenheit (°F)), which can occur from January to October in some spring habitats (Sandel 2007; Mettee 2008; Petty and Ruble 2011).

The spring pygmy sunfish is adapted to spring habitats and requires stable water quality and quantity. This species is found in clear to slightly stained spring water within spring heads (where cool water emerges from the ground), spring pools (water pool at spring head), spring runs (stream or channel downstream of spring pool), and associated spring-fed wetlands located in the Tennessee River drainage in the Eastern Highland Rim physiographic province and Dissected Tablelands in northern Alabama (Marbut et al. 1913; Warren 2004; Service 2012). Spring discharge from Beaverdam Spring has been calculated at 127 liters per second (L/s) (4.5 cubic feet per second (cfs)) (Cook et al. 2013). Historical flow rates for Pryor Springs and Moss Spring indicate that the spring pygmy sunfish is associated with moderately flowing springs of the second to fourth order (McMaster and Harris 1963; Chandler and Moore 1987Service 2012).

In addition to the habitat requirements described above, designated critical habitat for this species includes the following physical or biological features as essential to the conservation of the spring pygmy sunfish (Service 2019):

1. Springs and connecting spring-fed reaches and wetlands that are geomorphically stable and relatively low-gradient. This includes headwater springs with spring heads (water source), spring runs, and spring pools that filter into shallow, vegetated wetlands.

2. Yearly averages of water quality with optimal temperatures of 14 to 20 °C (57-68 °F); pH of 6.0 to 7.7; dissolved oxygen of 6.0 parts per million (ppm) or greater; low concentrations of free or suspended solids with turbidity measuring less than 15 nephelometric turbidity units (NTU) and 20 mg/l total suspended solids (TSS).

3. A hydrologic flow regime (magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain spring habitats. The instream flow from groundwater sources (springs and seeps) maintains an adequate velocity and a continuous daily discharge from the aquifer that allows for connectivity between habitats. Instream flow is stable and does not vary during water extraction, and the aquifer recharge maintains adequate levels to supply water flow to the spring head. The flow regime does not significantly change during storm events.

4. Presence of macroinvertebrates used for prey base or food, including *Daphnia* spp.*,* amphipods, chironomids (non-biting midges), or small snails.

5. Aquatic, emergent, and semi-emergent vegetation along the margins of spring runs and submergent vegetation that is adequate for breeding, reproducing, and rearing young; providing cover and shelter from predators; and supporting the macroinvertebrate prey base. Important species include:

    a. Submergent filamentous vegetation such as *Ceratophyllum echinatum* (spineless hornwort), *Myriophyllum heterophyllum* (two-leaf water milfoil), and *Hydrilla verticillata* (hydrilla);
    b. Emergent vegetation such as *Sparganium spp.* (bur reed), *Polygonum* spp. (smartweed), *Nasturtium officinale* (watercress), *Juncus* spp. (rush), and *Carex* spp. (sedges); and
    c. Semi-emergent vegetation such as *Nuphar luteum* (yellow pond lily), *Utricularia* spp. (bladderwort), and *Callitriche* spp. (water starwort).

    We note that as the designation of critical habitat (Service 2019) cites, the spring pygmy sunfish has been associated with a wide variety of aquatic plants, including nonnative species; however, habitat conservation efforts should prioritize native plants for the recovery of the species. *Hydrilla verticillata* is a nonnative species that can provide habitat for spring pygmy sunfish. However, at high densities, this aquatic plant can form dense monocultures that degrade habitat quality, reduce native vegetation, and negatively affect ecological function.

The spring pygmy sunfish faces several limiting factors. These factors include a restricted range; vulnerability to stochastic events such as extreme droughts, toxic spills, and alteration of spring recharge areas; habitat fragmentation from structures such as impoundments, bridges, and culverts or as a result of conditions that prevent dispersal such as lack of appropriate aquatic plants used for cover; and decreased water quality and quantity (Service 2012). Additionally, genetic bottlenecking and inbreeding depression could limit the ability for natural recovery, as evidenced by genetic diseases identified in Pryor Spring prior to the population's extirpation (Sandel 2011).

The spring pygmy sunfish is assigned a recovery priority number of 8, which indicates that the species faces a moderate degree of threat and a high recovery potential. The degree of threat is considered moderate because although this species is not currently in danger of extinction throughout all or a significant portion of its range, increasing threats from declining water quality and water quantity and extreme weather events such as droughts are likely to occur and negatively affect this species and its habitat in the future (Service 2013). The viability of the spring pygmy sunfish is reduced from effects of past and ongoing stressors, including increased water temperatures, stormwater runoff, habitat fragmentation, and groundwater extraction (Service 2013). Recovery potential is considered high because most of the species' habitat is on conservation lands, including National Wildlife Refuge System lands, although intensive

management and cooperation with partners and landowners adjacent to conservation lands may be required to ensure suitable conditions are maintained (Service 2024).

RECOVERY STRATEGY

The recovery strategy provides a concise overview of the envisioned recovered state for spring pygmy sunfish, 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 spring pygmy sunfish's recovery.

The overall recovery strategy for spring pygmy sunfish is to improve the number and distribution of resilient populations throughout its range in the Tennessee River system in northern Alabama, to protect and restore its habitat, and to alleviate threats to the species so these efforts will be successful. The initial recovery strategy for the spring pygmy sunfish is to ensure extant populations continue to thrive by controlling and reducing stressors and by restoring healthy, self-sustaining populations throughout the historical range while also restoring and maintaining high quality spring habitats. Habitat alteration and impoundments have converted many miles of flowing river reaches into more lentic, or lake-like, environments. This habitat alteration has inundated and destroyed habitats previously occupied by the spring pygmy sunfish. It has also fragmented occupied spring systems into isolated populations that are less resilient and prevented recolonization and genetic exchange, which leaves each population more vulnerable to stochastic events and extirpation. Additionally, effects associated with development and poor agriculture practices have degraded or continue to degrade environmental conditions on which the species depends through various point source and non-point source discharges into streams, water withdrawals for irrigation, and increased amounts of impervious surfaces that alter groundwater recharge. Periodic evaluations of the status of recovery efforts and extant populations will be used to measure success.

Recovery efforts will focus on further investigating and addressing potential causes of population extirpation while continuing to stabilize existing populations through active management of spring habitats. Where necessary, captive propagation, head-starting, and translocation will be used to re-establish populations into unoccupied habitat. To investigate and address potential causes for declines, recovery efforts will focus on reducing sediment inputs, improving water quality, promoting native submergent vegetation, conducting outreach to increase support and awareness for the species, and conducting research to identify other factors that may be contributing to declines and to identify emerging threats.

Recovery efforts will also focus on reducing threats that could negatively affect reproduction or recruitment of young into populations, increase stress to remaining individuals in the wild, or alter habitat such that survival is reduced. Ensuring extant populations continue to flourish and maintaining habitat connectivity such that normal metapopulation dynamics can proceed are both particularly important for the recovery of this species. Local landowners outside of designated conservation lands will be encouraged to participate in voluntary stewardship programs. Local, state, and federal entities will be engaged to ensure existing water quality standards are adequate to promote species recovery and that best management practices to achieve those standards are

systematically implemented. Within conservation areas, management strategies that benefit the species will be developed and implemented.

RECOVERY CRITERIA

Recovery criteria are statutorily required objective, measurable descriptions of the recovered state for spring pygmy sunfish, 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 spring pygmy sunfish 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 delisting recovery criteria reflect the best available scientific and commercial information for spring pygmy sunfish 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 spring pygmy sunfish (Table 1; Service 2013). 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 listing (4(a)(1)) factors and threats that affect the viability and persistence of the spring pygmy sunfish and associated recovery criteria and actions.

Listing Factor	Threat	Recovery Criteria	Recovery Actions
A, D	Reduced Water Quality and Quantity	1, 2, 3	1, 2, 3, 4, 5
A, E	Habitat Fragmentation	1, 3	1, 2, 3, 4
A, E	Effects from Severe Weather Events	1, 2, 3	1, 2, 3, 4

Criterion 1

The Beaverdam Spring/Creek Complex and Blackwell Swamp/Run populations remain extant, and positive or stable population trends over a 10-year period have been documented through standardized survey methods. Subpopulations within each population are distributed in such a

manner that immigration and emigration can occur, gene flow is sufficient, and resiliency to stochastic events is increased.

Justification for Criterion 1

Populations must exhibit a stable or increasing trend, natural recruitment, and multiple age classes across a 10-year monitoring period to be resilient to stochastic events. Ten years will account for approximately ten generations of the species since it is likely an annual species (Service 2012) and will provide sufficient time to observe and document population trends. When met, this recovery criterion will indicate resilience of current populations and will maintain redundancy and representation.

For the spring pygmy sunfish to adapt to changing conditions, the distribution of resilient populations needs to be representative of geographic, genetic, and ecological variation that exists across the species' historical range. The species has a limited range and has experienced range contraction as evidenced by the extirpated population in Cave Spring in Lauderdale County, Alabama. Therefore, it is necessary to maintain extant populations into the future to preserve an already limited adaptive capacity and ensure localized adaptations or novel mutations are not lost. Implementation of a conservation mechanism would provide long-term protection of currently extant populations and the discrete groundwater recharge area for each population. The conservation mechanism may include establishment of conservation lands or plans that consider the conservation of the species and broader environment.

Criterion 2

A minimum of one self-sustaining population occurs at an additional site in a distinct recharge area separate from the Beaverdam Spring/Creek Complex and Blackwell Swamp/Run recharge areas and within the historical range of the species.

Justification for Criterion 2

When met, this recovery criterion will indicate improved levels of redundancy and representation from current conditions that are more consistent with historical levels for spring pygmy sunfish. One additional population would increase the total number of resilient populations distributed throughout the species historical range and would reduce the risk of extinction. This additional population should be distributed within the historical range to further reduce the species' vulnerability to catastrophic events. Pryor Spring will be prioritized as this site. However, alternative locations within the lower bend of the Tennessee River in Alabama may be considered, provided a thorough analysis is conducted and concludes introduction is reasonably justified and that the spring pygmy sunfish will not have deleterious effects to other native species at the site. Implementation of a conservation mechanism would provide long-term protection for any discovered population or for any reintroduced population. The conservation mechanism may include establishment of conservation lands or plans that consider the conservation of the species and broader environment.

Criterion 3

Threats within occupied watersheds have been addressed and managed to the extent that water quality, water quantity, instream habitat, habitat connectivity, and aquatic communities will meet life history requirements of the spring pygmy sunfish and environmental pressures occur at levels with minimal effects on population 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 3

Declining water quality and quantity, habitat fragmentation, and effects from severe weather events, such as floods or droughts, are considered ongoing stressors or threats to the persistence and viability of spring pygmy sunfish (Service 2013). Management or abatement of these and other identified threats across the range of the spring pygmy sunfish must be achieved to meet life history requirements, achieve recovery, and delist the species. Available habitat for the spring pygmy sunfish throughout its range should exhibit the physical or biological features outlined in the critical habitat rule (Service 2019). Successful habitat restoration and other conservation efforts will require collaborative efforts with partners over an anticipated 20-year period throughout the species' range.

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 (Service 1983). 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 spring pygmy sunfish (Table 2). Specific activities for each action are expanded upon in the RIS.

Table 2. Recovery action summary. Cost estimates are rounded to the nearest $100,000.

Related Recovery Criterion	Recovery Action ID Number	Recovery Action	Additional Information	Estimated Cost[1]	Recovery Action Priority[2]
1, 2	1	Increase knowledge of the biology and ecology of the species, particularly the needs of individuals and populations and their responses to threats.		$400,000	1

Related Recovery Criterion	Recovery Action ID Number	Recovery Action	Additional Information	Estimated Cost[1]	Recovery Action Priority[2]
1	2	Develop and implement a controlled propagation plan for the species, including an evaluation of the genetic structure and diversity of populations.	Propagate spring pygmy sunfish as needed to support augmentation of declining population, reintroduction into sites of extirpated populations, or introduction into areas not previously known to host the spring pygmy sunfish.	$400,000	1
1, 2	3	Develop and implement a long-term population and habitat monitoring program and consistently monitor the status of existing and reintroduced populations.	Use traditional, eDNA, and/or other methods to estimate abundance and define range extent of populations and search for undocumented occurrences of the species within its current and historical range.	$400,000	1
1, 2, 3	4	Maintain, enhance, restore, and protect habitat.	Use voluntary best management practices, bank stabilization, riparian buffer restoration, barrier removal, conservation easements, and land acquisition in occupied watersheds to protect extant populations and reduce threats. Long-term habitat management is implemented to focus on habitat restoration and to reduce habitat degradation for all watersheds occupied by spring pygmy sunfish.	$1,400,000	1

Related Recovery Criterion	Recovery Action ID Number	Recovery Action	Additional Information	Estimated Cost[1]	Recovery Action Priority[2]
2, 3	5	Coordinate with local, state, and federal partners to reduce sources of pollutants, to promote watershed stewardship, and to conduct outreach in local communities to gain support for conservation efforts.		$100,000	3
		Total Estimated Cost:		**$2,700,000**	

[1]Costs covered under existing programs are not included in this table.
[2]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 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 spring pygmy sunfish. 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 Tennessee River drainage. We estimate that the full implementation of the recovery actions would improve the status of spring pygmy sunfish so that it could be delisted within 20 years following the adoption of this recovery plan. We also estimate the total cost of recovery at $2,700,000. 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 spring pygmy sunfish 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.

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