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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R4-ES-2012-0068]

RIN 1018–AY19

Endangered and Threatened Wildlife and Plants; Threatened Species Status for Spring Pygmy Sunfish

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine threatened species status under the Endangered Species Act of 1973 (Act), as amended, for the spring pygmy sunfish (*Elassoma alabamae*), which is found in Limestone County, Alabama. The effect of this regulation is to add this species to the List of Endangered and Threatened Wildlife and implement the Federal protections provided by the Act for this species.

DATES: This rule is effective [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: This final rule is available on the Internet at *http://www.regulations.gov* and at the Mississippi Ecological Services Field Office site. Comments and materials received, as well as supporting documentation used in the preparation of this rule, are available for public inspection at *http://www.regulations.gov*. All of the comments, materials, and documentation that we considered in this rulemaking are available by appointment, during normal business hours at: U.S. Fish and Wildlife Service, Mississippi Field Office, 6578 Dogwood View Parkway, Jackson, MS 39213; telephone 601-321-1122; facsimile (601-965-4340).

FOR FURTHER INFORMATION CONTACT: Stephen Ricks, Field Supervisor, U.S. Fish and Wildlife Service, Mississippi Ecological Services Field Office (see **ADDRESSES** section). If you use a telecommunications device for the deaf (TDD), call the Federal Information Relay Service (FIRS) at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Endangered Species Act (Act), a species warrants protection through listing if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

This rule lists the spring pygmy sunfish as a threatened species. In a separate, future rulemaking, we will finalize the designation of critical habitat for the spring pygmy sunfish.

The basis for our action. Under the Act, we can determine that a species is an endangered or threatened species based on any of five factors: (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; or (E) other natural or manmade factors affecting its continued existence. We have determined that the spring pygmy sunfish is threatened based on three of these five factors (Factors A, D, and E). Current threats to the species include ground and surface water withdrawal and impacts to water quality within the spring systems where this species currently occurs and historically occurred (Factor A). The species is also facing many potential threats in the foreseeable future. These include habitat modification in the form of planned urban and industrial development of land adjacent to spring pygmy sunfish habitat and the likely impacts to the spring system, including the surrounding aquifer recharge area. Increased urban and industrial development and associated secondary development and infrastructure can cause direct mortality as well as permanent loss and fragmentation of habitat (Factor A), which leads to isolated subpopulations, thereby impacting gene flow throughout the population (Factor E). Existing regulatory mechanisms are inadequate to reduce these threats (Factor D). However, conservation efforts that are currently being implemented through a candidate conservation agreement with assurances (CCAA), as well as additional conservation activities planned for the near future, reduce the impact of some of these threats. After carefully considering the current threats, current conservation activities, and future threats, we determined the spring pygmy sunfish meets the definition of a threatened species under the Act.

Peer review and public comment. We sought comments from three independent specialists knowledgeable in spring pygmy sunfish biology, basic conservation biology, and hydrology/spring system ecology to ensure that our determination is based on scientifically sound data, assumptions, and analyses. We invited these peer reviewers to comment on our listing proposal. We also considered all comments and information we received during two public comment periods.

Previous Federal Actions

Federal actions for the spring pygmy sunfish prior to October 2, 2012, are outlined in our proposed listing and critical habitat rule (77 FR 60180), which was published on that date. Publication of the proposed rule opened a 60-day comment period, which closed on December 3, 2012. On April 29, 2013 (78 FR 25033), we reopened the comment period for an additional 30 days, ending May 29, 2013. During this period, the public was invited to comment on the entire October 2, 2012, proposed rule as well as the draft economic analysis (DEA) of the proposed critical habitat designation. We did not receive any requests for a public hearing. We will finalize the designation of critical habitat for the spring pygmy sunfish in the near future.

Background

Species Information

Taxonomy and Species Description

The spring pygmy sunfish was discovered in 1937, but not described until 1993 (Mayden 1993, pp. 1-14). Genetic analysis by Quattro *et al*. (2001, p.1, pp. 27-226) confirmed the morphological diagnosis of the species by Mayden (1993, pp. 1-14) as valid. Sandel (2008, pp. 1-18; 2012, entire) determined the species to be the most distinctive member of the family Elassomatidae and provided preliminary population genetic data for the species.

We accept the characterization of the spring pygmy sunfish as a valid species based on the taxonomic characters distinguishing the species from other members of the *Elassoma* genus (Mayden 1993, p. 4). Its uniqueness is widely accepted by the scientific community, and there has been no discrepancy concerning its distinctiveness as a separate taxonomic entity (Boschung and Mayden 2004, p. 614).

A further description of the species is provided in the proposed rule (77 FR 60180; October 2, 2012).

Current Distribution

The range of the spring pygmy sunfish is very restricted. The species currently occupies about 5.9 miles (mi) (9.5 kilometers (km)) and 1,435 acres (ac) (580.6 hectares (ha)) of four spring pools and associated features confluent with the middle to upper Beaverdam Spring/Creek watershed. These spring pools, which include Moss, Beaverdam, Thorsen, and Horton springs, all in Limestone County, Alabama, along with associated spring runs, seeps, and wetlands, are collectively referred to as the Beaverdam Spring/Creek system. The Beaverdam Creek watershed is the least impacted groundwater-fed wetland in north Alabama as there are no other large springs in Lauderdale, Limestone, or Madison Counties that have not been developed for private or municipal use (Jandebeur 2012a, p. 1). The greatest concentration of spring pygmy sunfish occurs within the Beaverdam Spring site, which comprises 24 percent of the total occupied habitat for the species, and has experienced the least human-induced disturbance. However, Sandel (2011, p. 6) has documented declines in all sites within the system.

Historical Distribution and Status

The spring pygmy sunfish historically occurred at two other sites. This species was initially discovered in 1938, in Cave Springs, Lauderdale County, Alabama, where it was extirpated about a year later due to inundation from the formation of Pickwick Reservoir (Boschung and Mayden 2004, p. 615; Jandebeur 2012b, p. 1). In 1941, this species was also discovered in Pryor Spring within the Swan Creek watershed in

Limestone County, Alabama, by Tarzwell and Bretton, where it was noted to be common (Jandebeur 2011a, pp. 1-5). Sampling efforts in the Pryor Springs complex between 1966 and 1979 indicated a sparse population of spring pygmy sunfish west of Highway 31. None has been reported east of Highway 31. The exact location of the original 1941 collection in Pryor Spring is uncertain, but Jandebeur (2011a, pp. 1-5) speculates the original site to be solely west of Highway 31, within the Pryor Spring Branch (spring-fed wetlands) and not in Pryor Spring proper (spring head and pool), east of the highway. However, in 1984, in an effort to enhance this population in Pryor Spring, fish were moved from Moss Spring (Beaverdam Spring/Creek system) into Pryor Spring on both sides of Highway 31 (Mettee and Pulliam 1986, pp. 14-15). Reintroduction efforts continued into 1986 and 1987 (Mettee and Pulliam 1986, pp. 6-7). However, by 2007, the population was determined to be extirpated due to impaired water quality and quantity, likely attributable to contaminants from agricultural runoff (Sandel 2008, p. 2; 2011, pp. 3, 6; Jandebeur 2012d, pp. 1-2). Fluker (*in. litt*. 2012) noted the species could still exist in Pryor Springs but at such low numbers as to not be detectable.

The spring pygmy sunfish exhibits metapopulation structure within the Beaverdam Spring/Creek system (Sandel 2008, pp. 15-16; 2011, p. 8). A metapopulation is a group of individual populations that have some level of gene flow between them but are spatially isolated by unfavorable intervening habitat created naturally or anthropogenically (Akcakaya *et al.* 1999, pp. 183-184). With continued temporal isolation and lack of gene flow, some populations of the group may go extinct. However, if extinction occurs, there is a probability that the empty habitat patches will be recolonized by some members of the metapopulation (Levins 1968, pp. vi, 39-65; Levins

1970, pp. 77-107; Gotelli 1991, p. 768). For the spring pygmy sunfish, migration and continuity between spring pools is essential in maintaining the species' genetic diversity within the Beaverdam Spring/Creek system, and the species as a whole.

Sandel (2008, pp. 15-16; 2011, p. 8) found that the spring pygmy sunfish metapopulation in Beaverdam Spring/Creek is composed of isolated populations within the spring pools and spring runs. These pools and runs are connected spatially and temporally with periods of isolation and connectivity that are dependent on the extent and composition of aquatic vegetation, water quality, water quantity, and other parameters such as unintentional fish barriers at road crossings (e.g., clogged pipe or culvert) (Drennen 2010, pers. observ.). The individual spring pygmy sunfish populations within the metapopulation are intermittently connected via migration and recolonization after local extinction events. Although no supporting data were provided, Jandebeur (2011b, pp. 1-13) presented an alternate hypothesis that these populations of spring pygmy sunfish may have evolved in relation to beaver ecology, and that during migration of spring pygmy sunfish from beaver pond habitats, the species may colonize or recolonize existing habitats downstream, even though individual subpopulations may be extirpated due to drought or other ecological issues.

Habitat

The spring pygmy sunfish is a spring-associated (Warren 2004, p. 185) and groundwater-dependent (Jandebeur 2011, pers. comm.) fish endemic to the Tennessee River drainage in the Eastern Highland Rim physiographic province and Dissected

Tablelands (Marbut *et al*. 1913, p. 53) of Lauderdale and Limestone Counties in northern Alabama. Spring pygmy sunfish prefer clear to slightly stained spring water, occurring 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 (Warren 2004, pp. 184-185). The recharge area for Beaverdam Spring is about 1.7 square miles (mi^2) (1,088 ac) and extends from the western Beaverdam Creek watershed boundary, eastward near Oakland Spring Branch, north toward Huntsville Browns Ferry Road, and south to the bluff line where the spring discharges (Cook *et al*. 2013, p. 9). No contemporary water flow rates from the springs are available. However, historical flow rates for Pryor Spring (where the species once occurred) and Moss Spring of 800 to 5,000 gallons per minute (gpm) (3,000 to 19,000 liters per minute (lpm)) (tabulated from Chandler and Moore 1987, pp. 3-4), respectively, indicate that the spring pygmy sunfish is associated with moderately flowing springs of the second to fourth order (after Meinzer 1923 in Chandler and Moore 1987, p. 5; McMaster and Harris 1963, p. 28).

In general, natural spring pool habitats are typically static, persisting without disruption for long periods, even during droughts, in the absence of water extraction. However, the Beaverdam Spring/Creek system contains three altered springheads (Moss, Horton, and Thorsen), and only one springhead (Beaverdam Spring) that can be considered a natural surface spring pool habitat. Over the last 50 years, Moss, Horton, and Thorsen Springs have all experienced some degree of anthropogenic disturbance (Sandel 2011, p. 1-11; Jandebeur 2012d, pp. 1-22). This includes mechanical enlargement and water withdrawals that can cause excessive pool level fluctuations and be particularily damaging to the spring pygmy sunfish during times of drought. These springs seemed to have recovered biologically at some level; however, lower population numbers of the species are associated with these springs (Sandel 2011, p. 6). The long-term impacts on these springs' geological and hydrological functions from disturbance are not known. Beaverdam Spring pool, which is unaltered, has seasonal water levels consistent throughout the year (Jandebeur 2012a, pp. 1-16). Cook *et al.* (2013, p. 13) reported the discharge rates in Beaverdam Spring as 1.7 to 4.5 cubic feet per second (cfs) (776 to 2,020 gallons per minute (gpm)) and suggested that this wide range of discharge may originate from a variety of sources including agricultural withdrawals, a lack of vegetation in the recharge area, or a function of the site-specific geology. During drought periods, subsurface water levels in Bobcat and Matthews Cave on Redstone Arsenal, about 8 mi (12.9 km) east of Beaverdam Spring/Creek watershed, are typically lower for longer periods of time compared to wetter years (Moser and Rheams 1992, pp. 6-8; Rheams *et al*. 1992, pp. 7-20). No direct correlation between groundwater levels in nearby caves and wells and spring discharge rates or water levels in Beaverdam Spring has been determined. Cook *et al.* (2013, p. 14) found that withdrawal for the March 2012 base flow (the water in a stream that originates from groundwater seepage or springs and is not from rain runoff) from Beaverdam Spring was about 3.5 percent (9.6 million gallons per day) of the total flow (base flow and stormwater) of Beaverdam Creek, indicating the current withdrawals have little effect on the discharge rate of Beaverdam Spring. However, effects of water withdrawal are more obvious in the other springheads, especially during drought (Sandel 2011, p.6).

The species is most abundant at the spring outflow or water emergence (spring head) from the ground and spring pool area (Sandel 2009, p. 14), typically occupying areas with water depths from 5 to 40 inches (in) (13 to 102 centimeters (cm)) and rarely in the upper 5 in (13 cm) of the water column. The spring pygmy sunfish prefers patches of dense filamentous submergent vegetation, including *Ceratophyllum echinatum* (spineless hornwort), *Myriophyllum heterophyllum* (two-leaf water milfoil), and *Hydrilla verticillata* (native hydrilla). Other important plant species for this sunfish include emergent species such as *Sparganium* spp. (bur reed), *Polygonum* spp. (smartweed), *Nasturtium officinale* (watercress), *Juncus* spp. (rush), and *Carex* spp. (sedges); and semi-emergent vegetation including *Nuphar luteum* (yellow pond lily), *Utricularia* spp. (bladderwort), and *Callitriche* spp. (water starwort) (Mayden 1993, p. 11; Jandebeur 1997, pp. 42-44; Sandel 2011, pp. 3-5, 9-11; Kuhajda *in litt*. 2012). The spring pygmy sunfish is also associated with a variety of other spring-dwelling species, including amphipods, isopods, spring salamanders, crayfish, and snails (Mayden 1993, p. 11; Sandel 2011, pp. 11-12).

Life History

The spring pygmy sunfish has low fecundity (reproductive capacity) indicating a species that is adapted to and requires highly stable groundwater-dependent habitats and an ecological dependence upon unchanging habitats in early life stages (Rakes *in litt*. 2012). The species is short-lived (essentially an "annual") and becomes shorter-lived and extremely vulnerable to population extirpation as water temperatures rise (Rakes *in litt.* 2012). Adults reproduce from January to October. Spawning begins in March and April, when water quality parameters are within a suitable range (pH of 6.0 to 7.7 and water temperatures of 57.2 to 68 degrees Fahrenheit (°F) (15 to 20 degrees Celsius (°C)) (Sandel 2007, p. 2; Mettee 2008, p. 36; Petty *et al.* 2011, p. 4). Spring pygmy sunfish produce about 65 eggs, and hatching occurs from April to September (Sandel 2004-2009, pers. observ.). Two spawning attempts per year have been reported in captivity (Petty *et al*. 2011, p. 4). In captivity, the spring pygmy sunfish may live slightly longer than 2 years, but normally their life span is 1 year or less (Boschung and Mayden 2004, pp. 614-615). Compared to other pygmy sunfishes, spring pygmy sunfish have the highest average number of eggs per spawn, but the lowest percentage of egg survival, which increases the species' vulnerability (Mettee 1974, p. 38).

Summary of Comments and Recommendations

In the proposed rule published on October 2, 2012 (77 FR 60180), we requested that all interested parties submit written comments on the proposal by December 3, 2012. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. A newspaper notice inviting general public comment was published in the Huntsville *Times* on October 14, 2012. We did not receive any requests for a public hearing. On April 29, 2013, we published a notice (78 FR 25033) reopening the comment period on the October 2, 2012, proposed rule (77 FR 60180), announcing the availability of our

DEA on the proposed critical habitat designation, and requesting comments on both the proposed rule and the DEA. This comment period closed on May 29, 2013.

During the comment periods for the proposed rule, we received a total of 18 comments on the proposed listing of the spring pygmy sunfish and proposed designation of critical habitat. In this final rule, we address only the comments regarding the proposed listing of this species, and we will address comments related to critical habitat in the final critical habitat rule that will publish in the **Federal Register** in the near future. All comments we received either expressed an opinion on the proposed listing or provided additional background information on the species including its habitat, threats, and/or its conservation needs. Ten of the 18 commenters specifically commented on the species' proposed listing as threatened. Two expressed opposition to the listing, and the remaining eight supported the species' listing, with six of these eight recommending an endangered designation instead of the proposed threatened designation. Two commenters were affiliated with a State agency (Geological Survey of Alabama), and all remaining comments were received from nongovernmental organizations or individuals. All substantive information provided during both comment periods related to the listing decision has either been incorporated directly into this final determination or is addressed below.

Peer Review

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from three knowledgeable individuals with scientific expertise that included familiarity with the spring pygmy sunfish and its habitat, biological needs, and threats. We received responses from all three of the peer reviewers.

We reviewed all comments we received from the peer reviewers for substantive issues and new information regarding the listing of the spring pygmy sunfish. The peer reviewers generally concurred with our methods and conclusions and provided additional information, clarifications, and suggestions to improve the final rule. Two of the three peer reviewers were in support of the listing, although they recommended that we list the species as endangered. The third peer reviewer provided additional information, clarification, and suggestions to improve the final rule and remarked about the difficulty in assessing the hydrology and groundwater issues in the area, but did not specifically comment on the species' proposed listing. Peer reviewer comments are addressed in the following summary and incorporated into the final rule as appropriate.

Peer Reviewer Comments

This section focuses on comments from peer reviewers and our responses to them. However, we have also included other public comments in this section (referred to as "other commenters") if those comments were related in topic to peer reviewer comments.

(1) *Comment*: Two of the three peer reviewers and two other commenters stated that the species should be listed as endangered and not as threatened. They stated

that endangered status was more appropriate for this species since it was confined to a single population that is at risk of extirpation. They cited the establishment of the current CCAA as insufficient justification for the proposed threatened status due to threats to the species outside the boundaries of the CCAA from the projected growth of the Huntsville area. In addition, they noted that all protection afforded to the species through the CCAA could be nullified as the landowner can opt to terminate the CCAA with notice.

Our Response: The determination to list the spring pygmy sunfish as threatened was based on the best available scientific and commercial data on its status, the existing and potential threats to the species, and current and proposed conservation measures through CCAAs (see **Summary of Factors Affecting the Species** and **Determination** sections, below). Though the spring pygmy sunfish is confined to a single population, the protection afforded to the species and its habitat through the established Belle Mina Farms CCAA ameliorates the current threats to the species to the point that threatened status is appropriate. The Belle Mina Farms CCAA provides protection for the largest population of the species within the springhead and spring pool of about 165 ac (66.8 ha) and 963 ac (390 ha) (88.5 percent) of the recharge area. The middle section of the species' range, which is downstream from Belle Mina Farms, is owned by two landowners who are currently working with the Service to protect and manage their section of habitat for the species through proposed CCAAs. These conservation actions will reduce the severity of certain threats to the species outlined under Factor A (see below) within the upper and middle portions of the Beaverdam Spring/Creek and Moss Spring sites. The remaining species' habitat in the lower reach of the Beaverdam

Spring/Creek system, though of lower quality, is federally owned and protected within the Wheeler National Wildlife Refuge (NWR). We acknowledge that large-scale residential and industrial development in association with the growth of the City of Huntsville could pose a serious future threat to the species and its habitat.

The Belle Mina Farms CCAA includes conservation measures to minimize impacts to the species and its habitat caused by livestock, chemical usage, stormwater runoff, deforestation, development, and groundwater removal (see specifics under *Factor A* discussion, below). Therefore, it reduces the immediacy of the threats to the species and its habitat to the point where the spring pygmy sunfish is not in danger of extinction (endangered). Rather, it is likely to become endangered throughout all or a significant portion of its range within the foreseeable future when considering the future threats it faces from potential residential, commercial, and industrial development in the vicinity and therefore, it meets the definition of a threatened species under the Act (16 U.S.C.1531 *et seq*.). We acknowledge that landowners have the option to terminate CCAAs with notice; however, our assessment is based on the protection this agreement currently affords the species and its habitat.

(2) *Comment*: One peer reviewer commented that the case for excessive groundwater usage was not documented sufficiently in the proposed rule and the cause for low spring water levels has not been demonstrated to be seasonally variable, the result of extraction, or a combination of both. He further stated that basing species' habitat vulnerability on general statements of groundwater occurrence, recharge, and movement should be better documented with local data and monitoring information if possible.

Another individual commented that there were no data to support the claim that groundwater withdrawal had negatively affected the species.

Our Response: We reviewed available hydrological information (Erman 2002; Field and Sullivan 2003; Younger 2007; Likens 2009; Healy 2010) in our assessment of threats to the species; this information included local hydrological information such as The Geological Survey of Alabama's (GSA) studies of caves in the Tennessee River Valley area near the Beaverdam system (Moser and Rheams 1992, pp. 6-8; Rheams *et al*. 1992, pp. 7-20) and Cook *et al*.'s (2013) recent study of the recharge area of the Beaverdam Spring/Creek system. We have incorporated information from these studies into appropriate sections in this final rule.

The effects of pumping or diversion of springs and its negative consequences to spring-dependent species, such as the spring pygmy sunfish, are well documented in the literature (e.g., Williams and Etnier 1982; Cooper 1993; Hubbs 1995; Kuhajda 2004; Likens 2009; see **Summary of Factors Affecting the Species**, *Factor A*). Sandel (in Kuhajda *et al*. 2009, pp. 16,19) documented a negative relationship between excessive pumping activities and degraded habitat in Beaverdam Spring at Lowe's Ditch and in Horton and Thorsen springs. A 99-percent decline of the spring pygmy sunfish population was estimated at Thorsen Spring following water extraction and the resulting desiccation of vital aquatic vegetation (see **Summary of Factors Affecting the Species**). Information concerning the smaller springs within the system, i.e. Moss, Thorsen, and Horton, along with Pryor Spring, which is unoccupied by the species, indicates that groundwater and surface water extraction, along with drought, contributed to the destruction of the species' habitat (Sandel 2011, p. 6). Thus, based on the best scientific and commercial information available on spring systems and site-specific monitoring studies, we have determined that excessive groundwater extraction poses a current and future threat to the spring pygmy sunfish (see **Summary of Factors Affecting the Species**, *Factor A*). However, subsurface groundwater movement in this region of Alabama is quite complex, and more studies are needed. We agree that these additional studies will increase our understanding of the hydrological and biological dynamics of the spring system where the spring pygmy sunfish occurs.

(3) *Comment*: One peer reviewer commented that potential threats from chemical contaminants may be somewhat overstated based on generalized watershed information taken from overview book sources. Another individual commented that there were no data to support the claim that pesticides and nitrification were threats to the species.

Our Response: The best available scientific and commercial data, as presented in the **Summary of Factors Affecting the Species** section, on the prevalence of contaminants within the Beaverdam Spring/Creek watershed and their negative effects on aquatic organisms and specifically on the spring pygmy sunfish, indicate that contaminants have been a factor in the decline of the spring pygmy sunfish. Baseline contaminant trend information has been collected for decades within the Tennessee Valley surface and ground waters by the U.S. Geological Survey, GSA, and other sources documenting the general negative impacts of water quality contamination, whether from fertilizers or pesticides, on aquatic organisms. Specific information on the Lower

Tennessee River Valley area concerning surface and groundwater contaminants, along with the susceptibility of the aquifers to surface contaminants (Bossong and Harris 1987; Hoos 1999; Kingsbury 1999; Hoos and Powell 2002; Kingsbury 2003; Powell 2003), was used to characterize groundwater aquatic systems within the specific spring pygmy sunfish sites. Between 1999 to 2001, 35 pesticides and volatile organic compounds were detected in wells and springs within the Lower Tennessee River Valley (Woodside *et al*. 2004, pp. 1-2). Within the Eastern Highland Rim, the Beaverdam Spring/Creek watershed was shown to have the highest annual crop harvest, the highest total annual nitrogen use, the second highest annual phosphorus use, and elevated pesticides in the groundwater (Kingsbury 2003, p. 20; National Water Quality Assessment Program (NAWQA) 2009a,b; Mooreland 2011, p. 2; Cook *et al.* 2013, pp. 17-20). The concentration of nitrate as nitrogen and total phosphorus found in Beaverdam Spring was 2.77 milligrams per liter (mg/L), and 0.061 mg/L respectively, which is four and 1.7 times above the upper limit for wildlife protection set by the State of Alabama (Cook *et al.* 2013, pp. 17-19). Pesticides were likely the causative factor in the extirpation of the Pryor Springs population, which began its decline after the application of the pesticide 2,4-dicholorophenoxyactic acid (2,4-D) to that area in the 1940s (Jandebeur 2012c, pp. 1-18).

(4) *Comment*: One peer reviewer commented that statements derived from general knowledge and field observation over short periods of time and presented as fact reveal a bias in the proposal about damage to (and status of) spring pygmy sunfish.

Our Response: We thoroughly reviewed all available scientific and commercial data in preparing the proposed rule and in completion of this final rule. We sought and reviewed historical and recent publications and unpublished reports concerning the spring pygmy sunfish as well as literature concerning springs and threats to these systems. This included reliable unpublished reports, non-literature documentation, and personal communications with experts. We have incorporated the most current and historical scientific information available concerning the habitat and natural history of the species (see "*Species Information*" in **Background** section, above). Studies over the last decade have documented negative changes in the habitat and overall populations of the species (Sandel 2007, 2008, 2009, 2011; Jandebeur 2011a, 2012a). The proposed rule was reviewed by the public, which also included a peer review by three experts according to our policy (see *Peer Review* section, above). The other two peer reviewers, while providing additional information on habitat, life history, and threats, agreed that our threat assessment supported our decision to list this species, though they stated endangered status was more appropriate (see Comment 1). In short, we based our decision on the best scientific and commercial data available, as required by section 4(b)(1) of the Act.

(5) *Comment*: One peer reviewer commented that sampling may be inadequate relative to technique and method or insufficient in scope to adequately assess population size and distribution. Another individual stated that documented population declines were questionable and were a reflection of inadequate sampling methods.

Our Response: Relative abundance of spring pygmy sunfish estimated by catch-per-unit-effort (CPUE), the method that was employed, is a standard metric in biological surveys and is an approved method by the American Fisheries Society for estimating fish abundance (Murphy and Willis 1996, pp. 158-159), as is comparing this information through time at various collection sites. The information gathered during the field work is of sufficient extent and duration to document the rarity of the spring pygmy sunfish and its population decline and adheres to the information standard in section 4(b)(1) of the Act, as the use of the best scientific and commercial data available.

Comments from States

Section 4(i) of the Act states, "the Secretary shall submit to the State agency a written justification for his failure to adopt regulations consistent with the agency's comments or petition." We received two comments from individuals who are employees of a State agency. One of these individuals was also a peer reviewer of the proposed rule (see *Peer Reviewer Comments* section, above). Both provided additional information on the species' habitat and threats, which has been incorporated into this final rule, and neither stated a position on the proposed listing of the spring pygmy sunfish as threatened.

Public Comments

General Comments Issue 1: Science

(6) *Comment*: One individual commented that the listing of the spring pygmy sunfish is not supported by the best science and is not warranted. Service policy requires that peer-reviewed literature be considered scientifically superior. The Service based its proposed listing on information from the petition, which is scientifically unreliable since it consisted of unconfirmed information and personal observations. The Service should not base listing decision on potential threats that are pure speculation. Peer-reviewed literature and other data do not support a listing.

Our Response: See our responses to Comments 1, 2, 3 and 4, above. Under the Act, we determine whether a species is endangered or threatened due to any of the five factors (see **Summary of Factors Affecting the Species**, below), and we are required to make listings determinations on the basis of the best available scientific and commercial data available (16 U.S.C. 1533(a)(1) and (b)(1)(A)). The Service reviews and uses information on the biology, ecology, distribution, abundance, status, and trends of species, as well as information on current and potential threats, from a wide variety of sources as part of our responsibility under the Act. Some of this information is anecdotal, some of it is oral, and some of it is found in written documents. These documents include status surveys, biological assessments, and other unpublished material (i.e., "gray literature") from State natural resource agencies and natural heritage programs, Tribal governments, other Federal agencies, consulting firms, contractors, and individuals associated with professional organizations and higher educational institutions. We also use published articles from juried (peer-reviewed) professional journals whenever available.

All decisions are made on the basis of the best scientific and commercial data available and are subject to extensive internal review as well as external peer review by recognized authorities to help ensure that our decisions conform to contemporary scientific principles. We have incorporated the most current and historical scientific and commerical data available concerning the habitat and natural history of the species (see **Background** section, above). Our determination of threatened status for this species is supported by the information presented in our **Summary of Factors Affecting the Species** discussion, below, and complies with the Act's requirement to base our decision on the basis of the best scientific and commercial data available. We have also complied with our policy on peer review (59 FR 34270) as discussed under the *Peer Review* section above.

(7) *Comment*: One individual stated that our assertion that the spring pygmy sunfish occupies only 5 river miles of Beaverdam Creek is speculative and contradicted by prior research. It is unknown if the species has been extirpated from Pryor Springs, and based on previous surveys, Wheeler NWR contains numerous areas populated by the spring pygmy sunfish. Surveys to date have been limited to unaltered spring runs with filamentous, submergent vegetation. The habitat and range of spring pygmy sunfish is broader and more diverse, as there is documented evidence of sustained populations in areas of differing water qualities such as beaver dam impoundments, creek banks, and lake backwaters. Exploration of all potential habitats is needed to establish the range of the species and undertake any listing decision.

Our Response: Our determination that the spring pygmy sunfish's range is restricted to approximately 6 miles of Beaverdam Creek is supported by the best scientific and commercial data available as required under section 4(b)(1) of the Act. This species was historically known from three independent tributaries of the Tennessee River: Cave Spring, Pryor Spring/ Branch, and Beaverdam Spring. The Cave Spring population was extirpated in 1934, and the Pryor Spring/Branch System population was extirpated in the 1940s. Reintroduction efforts into Pryor Spring in the 1980s were ultimately unsuccessful, as the species has not been observed in this system since 2007 (see "Historical Distribution and Status" in the **Background** section, above). All of these spring habitat localities shared similar biological and physical parameters (see "Habitat" in **Background** section, above). This type of habitat is rare today, as these systems were mostly developed to meet demand for public water supply and irrigation. In fact, Beaverdam Spring is the only remaining large spring in north Alabama that has not been similarly developed (see **Summary of Factors Affecting the Species** section, below). Extensive fish surveys within Limestone and Madison Counties in related spring systems with similar vegetation structure as in Beaverdam Spring, and also in different aquatic spring-related habitats, have not located any additional spring pygmy sunfish localities (Caldwell 1965; Armstrong 1967; Jandebeur 1979; Mettee and Pulliam 1986; Etnier 1990; Shute 1994; Jones 1995; Larson 1995; Mayden *et al*. 1995; Jandebeur 1997, 2011a; Sandel 2008, 2009, 2011). Though the species has been found in some habitats that have been altered from their original natural condition, such as a beaverdam, there is no evidence that these are sustaining populations. To the contrary, the latest data reported by Sandel (2011, p. 6), for collections within the spring pygmy sunfish's current range between 2005 to 2010, indicate declines in all known populations including Beaverdam Creek, and Moss, Horton, and Thorsen Springs. The spring pygmy sunfish was last documented to occur on the Wheeler NWR approximately 20 years ago in 1993; thus, we consider this area in the lower range of Beaverdam Spring/Creek system to be part of the historical range. Based on our review of the best available scientific and commerical data, including analysis of the species habitat and previous status surveys, the surveys for the species have been appropriate and have confirmed its rarity, vulnerability, and range.

(8) *Comment*: One commenter postulated that mechanical disturbance and siltation actually benefit the spring pygmy sunfish. He stated that the spring pygmy sunfish tolerates and thrives where there has been substantial modification to the spring habitat through agricultural and animal husbandry practices as evidenced by its long-term coexistence with cattle.

Our Response: There is no information or evidence to support the premise that the species thrives in habitat modified by livestock or in areas with siltation and disturbance. The best available scientific and commercial data indicate that habitat alteration has been a causative factor in the decline of the spring pygmy sunfish. The species is known in greatest numbers from the spring head of Beaverdam Spring/Creek, where there is no livestock impact and no evidence of problems with excessive sedimentation. The spring pygmy sunfish may be able to tolerate some degree of habitat and water quality modification for short periods of time and may be able to reestablish themselves given improved conditions. However, livestock impacts to aquatic habitat are well-documented in the scientific literature, and suspended sediments, which are stressors to aquatic organisms, are typically increased in aquatic habitats used by livestock. Excessive sediment directly impacts fish health and decreases water clarity, which reduces light penetration needed for plant growth and indirectly results in impacts to fish, and in particular, the spring pygmy sunfish's spawning and feeding sites (see **Summary of Factors Affecting the Species**, *Factor A* section).

(9) *Comment*: One individual commented that there are no data to support a metapopulation hypothesis for the spring pygmy sunfish.

Our Response: The best scientific and commercial data available support our conclusion that the spring pygmy sunfish exhibits metapopulation structure within the Beavedam Spring/Creek system. Studies by Sandel (2008, pp. 15-16; 2011, p. 8) found that the spring pygmy sunfish population in Beaverdam Spring/Creek is composed of isolated populations within the spring pools and spring runs, and that the individual spring pygmy sunfish populations are intermittently connected via migration and recolonization after local extinction events. This population structure is consistent with the definition of metapopulations (see "Historical Distribution and Status" in **Background** section, above).

(10) *Comment*: One individual stated that the Service's assertion that the spring pygmy sunfish is a separate and distinct species is questionable.

Our Response: We disagree. The commenter did not provide any data to support his statement. The best scientific and commercial data indicate that the spring pygmy sunfish is a distinct, well-described taxon. We are not aware of any disagreement within the scientific community concerning its taxonomic status (see "Taxonomy and Species Description" in **Background** section, above).

(11) *Comment:* One individual stated that we characterized water withdrawal for irrigation usage incorrectly for the Beaverdam Spring system, and we should have used information that presents water quantity issues, withdrawal rates, water volume usage, and specific connectivity among the various water features of the spring system.

Our Response: We agree that more detailed studies would contribute to a better understanding of water withdrawal usage in the Beaverdam Spring system. However, in accordance with the information standard under section 4(b)(1) of the Act, we used the best scientific and commercial data available in assessing water extraction usage in the Beaver Spring/Creek system. We gathered water extraction information from the Limestone County Water and Sewer Board, along with information from a recent initial assessment of the aquifer and recharge area by GSA (Cook *et al.* 2013, entire). As discussed in the **Summary of Factors Affecting the Species** section of this rule, commercial water withdrawal from the aquifer by the Limestone County pumping station, between 2006 and 2011, was over 1 billion gallons (3.9 billion liters) at an estimated flow rate of 450 gpm (1,740 lpm) (Holland 2011, pers. comm.). Groundwater withdrawal by the cities of Huntsville and Madison (east of the spring pygmy sunfish habitat), and the adjacent rural population, is estimated at 16 million gallons per day (62 million liters per day) (Hoos and Woodside 2001, p. 1; Kingsbury 2003, p. 2; Sandel 2007-2009, pers. comm.). Negative impacts to the spring pygmy sunfish from excessive ground water extraction are discussed in the **Summary of Factors Affecting the Species** section, below, and also in our response to Comment 2, above.

General Comments Issue 2: Procedural and Legal Issues

(12) *Comment*: One individual commented that the Service must not only examine and evaluate the raw data but must also make those data available to others. Internal materials relied upon by the Service have not been made available for public review.

Our Response: Complete lists of references, including unpublished information, cited in the proposed rule (77 FR 60180; October 2, 2012) and in this final rule are available on the Internet at *http://www.regulations.gov* at Docket No. FWS-R4-ES-2012-0068 and upon request from the Mississippi Ecological Services Field Office (see **ADDRESSES**, above). In addition, as stated in our proposed rule, all supporting documentation used in preparing the proposed rule was available upon request and for public inspection, by appointment, at the U.S. Fish and Wildlife Service, Mississippi Ecological Services Field Office. All supporting documentation used in our rulemakings is a matter of public record; however, the number of sources referenced is often voluminous. Therefore, it is not possible for us to post all information sources used on the Internet.

(13) *Comment*: One individual commented that listing was unnecessary in light of the current and proposed CCAAs and that these agreements are more successful at protecting the species than listing. Threats to the species can be alleviated through less restrictive means such as the use of best management practices (BMPs).

Our Response: We agree that CCAAs are a cooperative mechanism to manage and protect the spring pygmy sunfish. The CCAA (Belle Mina Farms) developed for the species identifies BMPs that adequately protect the species and its habitats from current land use practices within the areas enrolled in the CCAA. The two proposed CCAAs also identify similar BMPs. However, the conservation actions in the current and proposed CCAAs do not remove the threats to the species and its habitat to the point that listing is not necessary, especially when considering probable and potential impacts from planned residential and industrial development. In the **Summary of Factors Affecting the Species** and **Determination** sections, below, we discuss our analysis of the threats to the species weighed against the benefits provided through the current and proposed CCAAs. The primary threat to the species is from habitat modification (Factor A), most notably the large-scale industrial and residential development planned adjacent to this species' habitat, which has the potential to impact the hydrology and other aspects of the spring system. The use of BMPs outlined in the CCAAs are important measures in conserving the spring pygmy sunfish, particularly considering the current agricultural land use within the watershed. However, when land use changes to industrialization and urbanization, as is likely in this area, the standard BMPs from the CCAAs are inadequate to address the complex issues such as aquifer recharge, stormwater management, and chemical transport in association with development. In addition, there may be activities associated with the increased development, such as roadways and utility (e.g., water, sewer, and electrical) corridors outside of the landowner's control, that have the potential to impact land enrolled in the current and proposed CCAAs. Therefore, the spring pygmy sunfish needs the protection afforded to federally listed species under sections 7 and 9 of the Act to ensure its conservation.

(14) *Comment*: The Service does not have authority to take action for a purely intrastate species such as the spring pygmy sunfish. It is questionable if the Federal government can regulate such a species under the Commerce Clause of the U.S. Constitution. An action listing the spring pygmy sunfish is beyond the powers afforded to the Service and Federal Government.

Our Response: The constitutionality of the Act in authorizing the Services' protection of endangered and threatened species has consistently been upheld by the courts (e.g., *GDF Realty Investments, Ltd.* v. *Norton*, 326 F .3d 622 (5th Cir. 2003); *Gibbs* v. *Babbitt*, 214 F.3d 483 (4th Cir. 2000); *National Association of Homebuilders* v. *Babbitt*, 130 F.3d 1041 (D.C. Cir. 1997), *cert. denied*, 524 U.S. 937 (1998); *Rancho Viejo*

v. *Norton,* No. 01-5373 (D.C. Cir. 2003); and *United States* v. *Hill,* 896 F. Supp. 1057 (D. Colo. 1995)). All of these courts have held that regulation under the Act to protect species that live only in one State is within Congress' Commerce Clause power and that loss of animal diversity has a substantial effect on interstate commerce (*National Ass'n of Home Builders*, 130 F.3d at 1050-51; see *Rancho Viejo*, 323 F.3d at 310, n. 5). Thus, although the spring pygmy sunfish is currently known to occur only within the State of Alabama, the Service's application of the Act to add this species to the Federal List of Endangered and Threatened Wildlife is constitutional.

Summary of Changes from Proposed Rule

In response to comments, we have incorporated additional information pertaining to this species' conservation, life history, and habitat as provided by the peer reviewers and others. Specifically, we added new information on the hydrology of the Beaverdam Spring/Creek watershed into the **Background** and **Summary of Factors Affecting the Species** sections of this rule. In addition, we have edited our threat discussion under the **Summary of Factors Affecting the Species** section and most notably added new information pertaining to the proposed industrialization of the Beaverdam Spring/Creek watershed under the *Factor A* discussion.

Summary of Factors Affecting the Species

Section 4 of the Act and its implementing regulations (50 CFR 424) set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (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; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Increased human population growth in Limestone County of over 20 percent between the 2000 and 2010 census (Hill *in litt.* 2013), and the accompanying demand for water could alter the Beaverdam Spring/Creek system and its recharge areas through increased water extraction (pumping), diversion, and retention (Erman 2002, p. 8; Cook *et al.* 2013, pp. 33-34). Because springs provide shelter, thermal refuge, breeding sites, movement corridors, and prey source habitat for the spring pygmy sunfish, the species is dependent on water quantities sufficient to provide spring habitat that is stable and permanent (Erman 2002, p. 8). Within the spring pygmy sunfish range, the Beaverdam Spring pool area, which has the greatest concentration of spring pygmy sunfish, is the least disturbed of all springs in the system. Moss, Thorsen, and possibly Horton Springs, which have been altered in some manner over the last 60 plus years, were allowed to recover and stabilize; however, these springs support lower numbers of the species than Beaverdam Spring. The condition of Pryor Springs and spring run continued to deteriorate over time (Sandel 2008, pp. 1-31; 2011, pp. 1-3, 1-11; Jandebeur 2012c, pp. 15-16; 2013, pp. 2-5) to the eventual demise of the species at this site in 2007.

Urban and Industrial Development

The history of development of large springs does not inspire confidence that the Beaverdam Spring environs will be conserved as a natural ecosystem (Jandebeur 2012a, p. 22).   Groundwater-fed habitat suitable for the spring pygmy sunfish was historically more prevalent across the Tennessee Valley region of north Alabama than today, as these systems were mostly developed to meet demand for public water supply and irrigation, as well as recreational parks (Jandebeur 2012a, p. 1). Except for Beaverdam Spring, there are no large springs remaining in Lauderdale, Limestone, or Madison County that have not been developed for private or municipal use (Jandebeur 2012a, p. 22).

Urban development adjacent to the Beaverdam Spring/Creek system could fragment and directly impact suitable spring pygmy sunfish habitat by decreasing water quality and quantity, changing the aquatic vegetation structure, and limiting the species' movement throughout the system. When an area is urbanized, many impermeable surfaces are constructed such as roofs, pavements, and road surfaces. All are intentionally constructed to be far less permeable than natural soils and to remove stormwater quickly, which results in a reduction in direct recharge into the aquifer, increased stormwater runoff (Younger 2007, p. 39), acute and chronic changes in water quality parameters such as decreased oxygen levels, increased temperature, concentrations of toxic heavy metals or other molecules (Cooper 1993, pp. 402-406; McGregor and O'Neil 2011, pp. 5-15; Cook *et al*. 2013, pp. 33-34), and increased water quantity and flow velocity (Field and Sullivan 2003, pp. 326-333).

The stormwater flow velocity carries sediments that may scarify (make scratches or cuts in) rock and gravel substrates (Waters 1995, pp. 57, 66) and uproot aquatic vegetation, thereby destroying important foraging, spawning, and refuge habitat for the species (Field and Sullivan 2003, pp. 326-333). Excessive sediment has been shown to wear away and suffocate periphyton (organisms that live attached to objects underwater), disrupt aquatic insect communities, and negatively impact fish growth, physiology, behavior, reproduction, and survival (Waters 1995, pp. 109-118). Fish gills are delicate and easily damaged by fine sediment. As sediment accumulates in the gills, fish respond by excessively opening and closing their gills to try to remove the silt. If irritation continues, mucus is produced to protect the gill surface, which may impede the circulation of water over gills and hence interfere with respiration. Under extreme or prolonged exposure to sediments, fish may actually die due to physically damaging and clogging their gills (Berg 1982, pp. 177-195).

The spring pygmy sunfish is currently facing threats from ongoing development and from planned large-scale residential and industrial projects within the vicinity of the Beaverdam Spring/Creek watershed (Bostick and Davis 2013, pers. comm.; Hill *in litt.* 2013). Sandel (2011, p. 11) observed declines in the species' population numbers and attributed it to sedimentation from two nearby construction activities: the construction of a new sewer line adjacent to the spring system and the ongoing construction of the Ashbury subdivision 2.3 mi (3.7 km) northeast of the species' habitat. The Ashbury subdivision, adjacent to Moores Branch and draining into the upper Beaverdam Spring/Creek watershed, filled adjacent wetlands when residential housing, roads, utility crossings, and stormwater drains were constructed (U.S. Army Corps of Engineers 2011, pp. 1-6).

The City of Huntsville's Master Plan for Western Annexed Land (Sasaki 2011, pp. 1-83) proposes developing a total of 10,823 ac (4,379.9 ha) adjacent to spring pygmy sunfish habitat. More than 68 percent of the proposed development area is adjacent to the Beaverdam Spring/Creek watershed and consists of four major industrial sites encompassing approximately 4,000 ac (1,619 ha) (Bostick and Davis 2013, pers. comm.). The Huntsville Master Plan would cover much of the known recharge area with residential, commercial, and industrial development (Jandebeur 2012a, p. 20). The restricted-use area for subdivision development, within the City of Huntsville, is a minimum of 25 ft (7.6 m) from the perimeter of a perennial spring. However, no restrictions are set forth for ephemeral springs or seasonal groundwater seepages (City of Huntsville 2007, p. 28), which include many of the ephemeral springs, seepages, and streams draining into the Beaverdam Spring/Creek watershed. These features are necessary for maintenance of seasonal flow rates. Filling them or converting them to developed areas could therefore adversely affect the spring pygmy sunfish. In addition, there are roads proposed to connect the planned developments with the Interstate 65 and Interstate 565 corridors (Sasaki 2011, pp. 1-83), along with feeder roads and improvements on primary and secondary existing roadways in support of new residential and industrial projects (Sasaki 2011, pp. 1-83; Hill *in litt.* 2013). Developed, paved-over areas (impervious substrate) promote runoff and inhibit infiltration, changing water flow rates from slow and incremental to fast and localized, because stormwater is directed via surface routes into specific areas of the receiving stream, rather than infiltrating into the soil or draining naturally into surface water.

Pumping or diversion of springs creates unstable conditions for spring-dependent species such as the spring pygmy sunfish through fluctuating water levels and temperature changes (Williams and Etnier 1982, pp. 11-18; Hubbs 1995, pp. 989-990; Kuhajda 2004, pp. 59-63). The incremental and cumulative groundwater recharge effects on the habitat of the spring pygmy sunfish may not become evident for years (Cooper 1993, pp. 402-406; Likens 2009, p. 90). Within north Alabama, the availability of large quantities of groundwater from springs has been an important factor in industrial and urban development (Warman and Causey 1963, p. 93). It is estimated that, by 2015, the population in Limestone and Lauderdale Counties will increase dramatically (Roop 2010, p. 1; Hill *in litt. 2013*), along with expanding urbanization and industrialization (Sasaki 2011, pp. 1-83). The potential over-development of groundwater resources, especially in the recharge areas for Beaverdam Spring, Moss Spring, and the Beaverdam Creek, raises concerns about the potential loss of groundwater-fed habitat essential to the only remaining population of the species (Jandebeur 2012a, p. 20-21).

The Fort Payne Chert of the Early Mississippian Age is the principal aquifer of spring pygmy sunfish habitat and provides groundwater to all of Limestone County (McMaster and Harris, Jr. 1963, p. 1; Cook *et al.* 2013, pp. 3-7). Groundwater in the County is ultimately derived from percolation of precipitation (McMaster and Harris, Jr. 1963, p. 17; Cook *et al.* 2013, pp. 3-13) into the aquifer system. In urban settings, percolation of rainwater to the aquifer may be disrupted due to less pervious zones and more shunting of rainfall into stormwater systems (Younger 2007, pp. 117-121; Healy 2010, pp. 70-72). Change in land use from rural to urban/industrial (Bostick and Davis 2013, pers. comm.) within the Beaverdam Spring/Creek area could be detrimental to the spring pygmy sunfish due to negative changes in the water quality parameters such as oxygen and temperature, along with changes in water quantity, such as increased stream flow and velocity, due to increased amounts of impervious materials and associated stormwater runoff in the watershed (Cook *et al*. 2013, pp. 33-34). This may be coupled with a subsequent reduction in precipitation infiltrating through the soil surface to the aquifer, which will ultimately reduce spring base flow (Field and Sullivan 2003, pp. 326-333; Healy 2010, p. 3).

Water Quantity

Excessive groundwater extraction from the aquifer supplying Beaverdam Spring/Creek is a threat to the spring pygmy sunfish (Drennen 2007-2011, pers. observ.; NAWQA 2009a,b; Sandel 2011, pp. 3-6) because of the reduction of the water levels in the aquifer and resultant decreased spring outflow (Williams and Etnier 1982, pp. 11-18; Hubbs 1995, pp. 989-990; Kuhajda 2004, pp. 59-63; Cook 2011, pers. comm.). Sandel (in Kuhajda *et al*. 2009, pp. 16, 19; 2011, pp. 3-6) documented a relationship between pumping activities in Beaverdam Spring (Lowes Ditch) area, and Horton and Thorsen Springs, and degraded spring pygmy sunfish habitat. Even though Moss Spring has never been directly pumped (Sewell *in litt.* 2013), the water extraction of the Beaverdam Spring area, specifically at Lowes Ditch, may have impacted Moss Spring water levels (Sandel 2011, pp. 6) and aquatic vegetation (Drennen pers observ. 2011). In Thorsen Spring, during 2007, water was extracted to a level that, in conjunction with the drought, destroyed vital aquatic vegetation and decreased the abundance of the spring pygmy sunfish by 99 percent (Sandel 2004-2009, pers. observ.; Sandel 2011, p. 6). The proximity of the spring pygmy sunfish's habitat to agricultural land throughout its range makes it vulnerable to drought and associated impacts due to the extraction of groundwater and surface water for agricultural uses (Cooper 1993, pp. 402-406). Sandel (in Kuhajda *et al*. 2009, pp.16, 19) roughly estimated that up to 16,000 gpm (62,000 lpm) of water was extracted from the Beaverdam Spring/Creek watershed for agricultural purposes during drought conditions during the 2008 growing season. He further noted in the field that this level of withdrawal desiccated and killed aquatic vegetation necessary for the spawning, foraging, and shelter of the species.

Commercial water withdrawal from this same aquifer by the Limestone County pumping station, between 2006 and 2011, was over 1 billion gallons (3.9 billion liters) at an estimated flow rate of 450 gpm (1,740 lpm) (Holland 2011, pers. comm.). Groundwater withdrawal by the cities of Huntsville and Madison (east of the spring pygmy sunfish habitat), and the adjacent rural population, is estimated at 16 million gallons per day (62 million liters per day) (Hoos and Woodside 2001, p. 1; Kingsbury 2003, p. 2; Hutson *et al.* 2005; Sandel 2007-2009, pers. comm.). Withdrawal of groundwater by pumping, at high levels such as those above, especially during drought conditions, can cause changes to water budgets (Healy 2010, p. 15) and the natural flow of spring systems (Alley in Likens 2009, p. 91). Pumping from wells beside streams also lowers groundwater levels and reduces surface water flow within streams and spring runs. In smaller streams, decreased flow caused by pumping can be large enough to create harmful effects upon the stream and its wildlife (Hunt 1999, pp. 98-102). Water extraction by pumping also causes a loss of aquifer storage and lowers the pressure in the aquifer (Theis 1935, p. 519), resulting in decreased spring flow velocity and quantity to adjacent streams. These reductions in the natural flow regime may adversely affect the spring pygmy sunfish.

In several large springs in the United States, groundwater extraction for public consumption and agricultural use has impacted federally listed fish species by decreasing groundwater levels. Examples include the endangered Devil's Hole pupfish (*Cyprinodon diabolis*) (Hoffman *et al*. 2003, p. 1248) and the endangered fountain darter (*Etheostoma fonticola*) (U.S. Fish and Wildlife Service 1996, p. 19). The whiteline topminnow

(*Fundulus albolineatus)* (Gilbert 1891), once endemic to Big Spring and Spring Creek, in Huntsville, Madison County, was determined to be extinct in 1971, due to over-pumping, cementing-over of streambank vegetation, and impoundment of the spring pool (Williams and Etnier 1982, pp. 10-11). Severe or excessive water extraction, along with drought in spring pygmy sunfish habitat, to the point that normal water levels may drop for a sustained time period, can cause desiccation, reduction, or change of essential aquatic vegetation necessary for the survival of the species (Sandel 2011, p. 6). A reduction in water quantity also exacerbates the concentration of pollutants that may have both an acute and a chronic negative impact on the species and its habitat (Cooper 1993, pp. 402-406).

The effects of water extraction on stream flow, in combination with drought, may be greater due to the overall decrease in water quantity in the stream. Decreased water levels, following pumping from the spring pool, correspond to decreased aquatic vegetation in the system. Less water quantity increases the dessication of vegetation, which may negatively impact the species (Jandebeur 1979, pp. 4-8; Mayden 1993, pp. 11-12) by reducing the vegetative cover and contributing to eutrophication of the water, as demonstrated by spring pygmy sunfish habitat impacts and subsequent population declines in Horton and Thorsen Springs (Sandel 2004-2009. pers. observ.; 2011, pp. 3-6). Duncan *et al.* (2010, pp. 18-20) showed a correlatation between the abundance of the endangered watercress darter (*Etheostoma nuchale)* in a similar spring system in Jefferson County, Alabama, to the abundance and diversity of aquatic vegetation.

Water Quality

The historical intensive use of chemicals within the Lower Tennessee River Valley in Alabama, including agricultural areas close to the Beaverdam Spring/Creek watershed and the recharge areas, may be a potential threat to the species. Contaminant transport occurring with sediment in surface stormwater runoff, or resulting from agricultural runoff, can enter the spring pool and spring run directly without first entering the groundwater. During 1999-2001, 35 pesticides and volatile organic compounds such as tetrachloroethylene and trichloroethylene were detected in wells and springs within the Lower Tennessee River Valley (Woodside *et al*. 2004. pp. 1-2). Increased toxic concentrations of herbicides coupled with increased desiccation of aquatic vegetation due to drought (Jandebeur 2012c, pp. 1-6, 13) may have contributed to the demise of the Pryor Spring/Branch population of the spring pygmy sunfish.

The ongoing, intensive agricultural practices and proposed urbanization and industrialization plans (Bostick and Davis 2013, pers. comm.; Hill *in litt*. 2013) within the immediate area of the watershed threaten to contaminate the groundwater in the aquifer supplying the Beaverdam Spring/Creek system (Healy 2010, p. 70). Along with volatile organic compounds, general-use pesticides applied along road and power line rights-of-way in urban areas to control woody vegetation and weeds (tebuthiuron and prometon) were detected in wells in Lower Tennessee River Valley aquifers between 1999-2001 (Woodside *et al*. 2004, pp. 16-20). Transportation of contaminants to the aquifer by recharge water can be slow and steady or highly episodic over time (Healy 2010, p. 75).

Fertilizers and pesticides are transported to the aquifer by recharge, or into surface stormwater routes, where they eventually enter springs and are a threat to the survival of fishes found there (Carson 1962, pp. 41-43; U.S. Fish and Wildlife Service 1996, pp. 35-36; Hoffman *et al*. 2003, p. 1248). Toxins can concentrate when spring flow is reduced, posing an even greater threat to spring fishes. The Beaverdam Spring/Creek watershed has the highest annual crop harvest, the highest total annual nitrogen use, and second highest annual phosphorus use, along with elevated pesticide usages detected in groundwater, within the Eastern Highland Rim (Kingsbury 2003, p. 20; NAWQA 2009a,b; Mooreland 2011, p. 2; Cook *et al.* 2013, pp. 17-18). Both the historical and extant spring pygmy sunfish populations in Limestone County (Beaverdam Spring/Creek, Pryor Springs) are within the Wheeler Lake Basin (southern boundary of Limestone County), where Tsegaye *et al*. (2006, pp. 175-176) found that rapid urbanization, with associated decrease in agricultural land cover, is likely responsible for water quality degradation in streams from non-point source phosphorus pollution. Natural background levels of phosphorus in groundwater are normally low (Wetzel 1983, p. 281; Cook *et al.* 2013, pp. 18). However, urbanization increases the amount of phosphorus from residential fertilizers and storm sewer drainage (Wetzel 1983, p. 281) that may enter groundwater recharge areas. Phosphorus limits biological productivity (Wetzel 1983, p. 255) by impacting organismal metabolism. Nitrogen also impacts aquatic life. For instance, un-ionized ammonia (which contains nitrogen) is highly toxic to fish (Hoffman *et al*. 2003, p. 681). The planned housing and industrial development neighboring spring pygmy sunfish habitat is likely to increase phosphorus and nitrogen levels in the future. Surface water contamination sources are typically nitrate (from fertilizer and animal waste), bacteria, and urban runoff (runoff from yards and asphalt that has heavy metals and pesticides/herbicides). Ground water in karst areas is impacted by surface water with these same contaminants (Tennessee Department of Environment and Conservation 2012, p. 9; Cook *et al.* 2013, pp. 17-19). The concentration of nitrate as nitrogen and total phosphorus found in Beaverdam Spring was 2.77 mg/L, and 0.061 mg/L respectively, four and 1.7 times above the upper limit for wildlife protection (Cook *et al*. 2013, pp. 17-19). McGregor *et al.* (2008, pp. 5-20) found that increased urbanization around Matthews and Bobcat Caves, about 8 mi (12.9 km) east of Beaverdam Creek watershed, will likely affect the ground water and population abundance of the federally endangered Alabama cave shrimp (*Palaemonias alabamae*).

Specific aquatic plants, which the spring pygmy sunfish uses for spawning, shelter, and foraging, are also impacted by indiscriminate use of chemicals (Sandel 2011, pp. 1-5, 8-9; Jandebeur 2012c, p. 2). Since 1945, herbicide usage, cattle grazing, and irrigation have occurred throughout the spring systems and waterways that are habitat for this species (Jandebeur 1979, pp. 4-8). Aquatic vegetation management within Thorsen Spring, Horton Spring, and the Pryor Spring/Branch system has removed the spring pygmy sunfish's shelter vegetation, egg substrate, and food sites (Jandebeur 1979, pp. 4-8; Mayden 1993, p. 9; Jandebeur 2012d, p. 1-10). Agricultural chemical contamination results in sublethal toxic effects in fish species, affecting the immune system, hormone regulation, reproduction, and developmental stages (Hoffman *et al*. 2003, pp. 1056-1063, 1242). The spring pygmy sunfish's negative response to herbicides (Hoffman *et al*. 2003, p. 1242) is documented by the subsequent reduction and eventual loss of the population in Pryor Branch after the application of 2, 4-dichlorophenoxyacetic acid (2,4-D) to that area in the 1940s (Jandebeur 2012d, pp. 1-18). This herbicide is toxic to fish and aquatic invertebrates and has properties and characteristics associated with chemicals generally detected in groundwater contamination. Decaying vegetation caused by the application of this herbicide also impacts fishes by reducing dissolved oxygen levels (Environmental Protection Agency (EPA) Material Safety Data Sheet, undated, pp. 1-3).

Many of the same chemicals used in large-scale agricultural practices are also used by municipal entities, including urban and rural households. Stormwater runoff from city streets, construction sites, and storm sewers; household wastes; and leachate from septic tanks and landfills alter the sediment load in aquatic systems and deposit contaminants into surface and groundwater sources (Likens 2009, p. 90). Water quality degradation from chemicals will increase with the expected increase in urbanization and industrialization of the area.

Overgrazing by livestock is a major threat to springs, especially where animals have free range through spring systems and wetlands. Cows tend to congregate in wetland areas, where they consume and trample vegetation, thereby reducing shade around the spring and increasing the water temperature. Livestock also trample banks in springs and spring runs, leading to increased stormwater and sediment runoff, which eliminates habitat for invertebrate prey species (Sada *et al*. 2001, pp. 14-16; Erman 2002, p. 8). Excessive sediment runoff during stormwater events decreases water clarity, which reduces light penetration needed for plant growth and results in impacts to the spring pygmy sunfish's spawning and feeding sites (NAWQA 2009a,b; Sandel 2011, pp. 1-6, 8-9; Jandebeur 2012a, p. 2).

Timber harvesting and land clearing can also have impacts on spring water quality and associated spring species. Recent tree removal along the boundary of the Wheeler NWR, which is spring pygmy sunfish habitat and part of the Beaverdam Spring/Creek system, highlights the need for careful management of spring habitats (Hurt 2012, pers. comm.). The removal of the trees greatly reduced the buffer along the Beaverdam Spring/Creek system and will likely increase sedimentation into the stream during stormwater runoff. An appropriate mixture of shade and sunlight is needed for the proper growth and maintenance of vegetation in the spring environment. This vegetation is important to maintaining a stable water temperature and habitat for an invertebrate prey base. Reducing shade by mechanical logging and clearing can increase atypical spring flow, lead to greater spring run flow variability, and increase sedimentation (Erman 2002, p. 9) by altering the existing geomorphology and enhancing stormwater runoff.

Conservation Efforts to Reduce Habitat Destruction, Modification, or Curtailment of Its Range

When considering whether or not to list a species under the Act, we must identify existing conservation efforts and their effect on the species. Under the Act and our policy implementing this provision, known as the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE) (68 FR 15100; March 28, 2003), we must evaluate the certainty of an effort's effectiveness on the basis of whether the effort or plan: Establishes specific conservation objectives; identifies the necessary steps to reduce threats or factors for decline; includes quantifiable performance measures for the monitoring of compliance and effectiveness; incorporates the principles of adaptive management; is likely to be implemented; and is likely to improve the species' viability at the time of the listing determination. In general, in order to meet these standards for the spring pygmy sunfish, conservation efforts must, at minimum, report data on existing populations, describe activities taken toward conservation of the species, demonstrate either through data collection or best available science how these measures will alleviate threats, provide for a mechanism to integrate new information (adaptive management), and provide information regarding certainty of the implementation (e.g., funding and staffing mechanisms).

The Service entered into a CCAA for the benefit of the spring pygmy sunfish with Belle Mina Farms, Ltd., and the Land Trust of Huntsville and North Alabama (Land Trust) on June 7, 2012. The area covered under the CCAA is approximately 3,200 ac (1,295 ha) and encompasses the upper 24 percent of habitat occupied by the Beaverdam Spring/Creek metapopulation, which is currently the only known population for the species. It also includes most of the spring recharge area (Cook *et al.* 2013, p. 44).

Under the CCAA, the landowner agrees to implement conservation measures to address known threats to the species. These measures will help protect the species on his property in the near term and also minimize any incidental take of the species that might occur as a result of conducting other covered activities now that we are listing the species under the Act. Conservation measures to be implemented by the landowner on this property will assist in the reduction of chemical usage and stormwater runoff from agricultural fields by establishing and maintaining vegetated buffer zones around Moss and Beaverdam Springs. The landowner also agrees to restrict timber harvest and cattle grazing within the Beaverdam Spring/Creek and Moss Spring habitats and to refrain from any deforestation, industrial/residential development, aquaculture, temporary or permanent ground water removal installations, and other potentially damaging actions without prior consultation with the Service. These actions will minimize impacts and help to maintain groundwater recharge of the aquifer and adequate spring flow. New information received from the GSA (Cook *et al.* 2013, p. 3) identified the recharge area of the Beaverdam Spring, which is about 1,088 ac (440.3 ha) and described as wooded upland and agricultural fields. The majority (about 88.5 percent) of the delineated recharge area is within the enacted CCAA as enrolled lands. This CCAA and corresponding conservation measures that occur within the majority of the recharge area (maintain status quo land use as agriculture) will protect the groundwater and spring system on the enrolled land (within Belle Mina Farms, Ltd.). The spring pygmy sunfish inhabits the designated protected area within the CCAA. The species depends on the clean water from the recharge area within the enrolled lands. There is longstanding agricultural usage by Bella Mina Farms, including cattle and irrigated cropland operations. Since 1983, Bella Mina Farms has been cooperating with the Service in conserving and maintaining the integrity of species' habitat in the Beaverdam Spring/Creek system. Bella Mina Farms has created and maintained a buffer zone around the Moss Spring pond population of the spring pygmy sunfish and managed cattle consistent with current grazing research, BMPs, and the spring pygmy sunfish's ecology.

Through the CCAA, Bella Mina Farms, Ltd., will continue to implement the existing conservation efforts on the enrolled land, as well as implement long-term strategies to protect the spring pygmy sunfish and its habitat within the protected area. According to the CCAA, if there is a 15-percent decline in the population of the species, the Service may propose additional water use management practices within the enrolled land to maintain the status quo of historical water usage within the protected area. We have provided technical assistance to the landowners concerning conservation measures and BMPs for the surface portion of the delineated recharge area. The Land Trust will conduct monitoring on the progress of the conservation actions and annual habitat analyses. Initial planning for species' population and habitat monitoring has begun.

The CCAA and associated enhancement of survival permit have a duration of 20 years; however, under a special provision of this CCAA, if at any time a 15-percent decline in the status of the spring pygmy sunfish is determined, there will be a reevaluation of the conservation measures set forth in the CCAA. If such a reevaluation reflects a need to change the conservation measures, the amended measure(s) will be implemented or the CCAA will be terminated and the permit surrendered.

Conservation efforts set forth in this CCAA are a positive step toward the conservation of the spring pygmy sunfish. These conservation actions will reduce the severity of some of the threats to the species (see discussion above) within the upper portion of the Beaverdam Spring/Creek and Moss Spring sites, which encompasses the upper 24 percent of occupied habitat in the Beaverdam Spring/Creek system. Presently there is no active protection for the 19 percent of the species' habitat within the middle reach of the Beaverdam Spring/Creek system. However, since early 2012, the Service has been working with two landowners to protect and manage this area for the spring pygmy sunfish, and we are currently in the process of negotiating CCAAs with these landowners and preparing them for public review and comment. The lower portion of the species' habitat (57 percent) is federally owned and protected, though it is considered lower quality habitat.

Despite these efforts, the large-scale development planned adjacent to this species' habitat and outside the boundaries of the land enrolled in the current CCAA and the land potentially enrolled in the two proposed CCAAs continues to pose a significant future threat to the spring pygmy sunfish and its habitat. Furthermore, since the Belle Mina Farms' CCAA has been just recently executed, there has yet to be long-term monitoring, which is needed to evaluate the overall effectiveness of these efforts.

Summary of Factor A

As discussed above, the spring pygmy sunfish and its habitat are currently facing the threats of both declining water quality and quantity. Excessive groundwater usage, and the resultant reduction of the water levels in the aquifer/recharge areas and decreased spring outflow in the Beaverdam Spring/Creek system, is believed to have negatively impacted the spring pygmy sunfish and its habitat. Contamination of the recharge area and aquifer from the intensive use of chemicals (i.e., herbicides, pesticides, and fertilizers) within the spring pygmy sunfish's habitat poses a threat to the species' survival. Ongoing stormwater discharge from agricultural lands and urban sites compounds the water quality degradation by increasing sediment load and depositing contaminants into surface and groundwater sources. In addition, the large-scale residential and industrial development planned adjacent to the Beaverdam Spring/Creek system will likely exacerbate the decreasing water quantity and quality issues within the habitat of the spring pygmy sunfish's single metapopulation. Overgrazing by livestock and land clearing near and within the spring systems reduces the vegetation in the spring and increases stormwater and sediment runoff, posing a threat to the population, particularly in the middle and lower portions of its range.

Based on our review of the best commercial and scientific data available, we conclude that the present or threatened destruction, modification, and curtailment of its habitat or range is currently a threat to the spring pygmy sunfish and is expected to persist and possibly escalate in the future, particularly in light of the increasing demands for groundwater and large-scale development that is planned near this species' habitat. While the CCAA has reduced some of the threats under this factor, it only covers a portion of the extant range of the species, and will not ameliorate all threats of ongoing and potential water quantity and water quality degradation. Additional conservation measures being pursued with key landowners and other stakeholders would also aid in reducing these threats to the species, but likewise, not to the level that water quantity and quality degradation would cease to be threats to the species.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The spring pygmy sunfish is not a commercially valuable species. However, this species has been actively sought by researchers since its discovery in 1937. Overcollecting may have been a localized factor in the historical decline of this species, particularly within the introduced population in Pryor Spring/Branch (Jandebeur 2012d, p. 14); however, the overall impact of collection on the spring pygmy sunfish population is unknown (Jandebeur 2012d, p. 14). The localized distribution and small size of known populations render them vulnerable to overzealous recreational or scientific collecting. However, at this time, we have no specific information indicating that overcollection rises to the level to pose a threat to the species now or in the future.

Therefore, we conclude that overutilization for commercial, recreational, scientific, or educational purposes does not constitute a threat to the spring pygmy sunfish at this time.

Factor C. Disease or Predation

We have no specific information indicating that disease occurs within spring pygmy sunfish populations or poses a threat to the species. Eggs, juveniles, and adult spring pygmy sunfish are preyed upon by some invertebrate species, parasites, and vertebrate species such as frogs, snakes, turtles, other fish, and piscivorus (fish-eating) birds. It is possible that predation increases when fish are concentrated in smaller areas when groundwater is depleted through water extraction and drought. However, we have no evidence of any specific declines in the spring pygmy sunfish due to predation.

Therefore, we conclude that the best scientific and commercial data available indicate, at the present time, that neither disease nor predation is a threat to the spring pygmy sunfish.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

The spring pygmy sunfish and its habitat are afforded some protection from surface water quality and habitat degradation under the Clean Water Act (CWA; 33 U.S.C. 1251 *et seq.*), the Alabama Water Pollution Control Act (Code of Alabama, sections 22-22-1 *et seq.*), and regulations promulgated by the Alabama Department of Environmental Management (Maynard and Gale 1995, pp. 20-28). While these laws have resulted in some improvement in water quality and stream habitat for aquatic life, such as requiring landowners engaged in agricultural practices to have an erosion prevention component within their farm plan, alone they have not been fully adequate to protect this species due to inconsistent implementation, monitoring, and enforcement. Furthermore, habitat degradation is ongoing despite the protection afforded by these laws.

The State of Alabama maintains water-use classifications through issuance of National Pollutant Discharge Elimination System (NPDES) permits to industries, municipalities, and others; these permits set maximum limits on certain pollutants or pollutant parameters. For water bodies on the CWA’s section 303(d) List of Impaired Water Bodies, States are required under the CWA to establish a total maximum daily load (TMDL) for the pollutants of concern that will bring water quality into the applicable standard. Many of the water bodies within the occupied range of the spring pygmy sunfish do not meet Clean Water Act standards (Alabama 2008 section 303(d) List of Impaired Water Bodies).

The State of Alabama's surface water quality standards, adopted from the national standards set by the EPA, were established with the intent to protect all aquatic resources within the State of Alabama. These water quality regulations appear to be protective of the spring pygmy sunfish as long as discharges are within permitted limits and are enforced according to the provisions of the CWA. Unregulated and indiscriminate groundwater and surface water extraction has been identified as a threat to spring species (see *Factor A* discussion, above). Within the State of Alabama, regulations concerning groundwater issues are limited (Alabama Law Review 1997, p. 1). Alabama common law follows a ”reasonable use rule” for the extraction of groundwater, and there is a statutory framework that regulates and governs groundwater extraction (Chapman and U.S. Forest Service 2005, p. 9; Alabama Water Resources Act, Code of Alabama, sections 9-10B-1 *et seq.*). Water users must file a declaration of beneficial use, be issued a certificate of use, and be permitted and monitored periodically. The Alabama Water Commission can place restrictions on certificates of use in certain designated water capacity stressed areas; however, the Alabama Water Commission has not identified any stressed groundwater areas in or near spring pygmy sunfish habitat. Large volumes of groundwater continue to be extracted in areas not identified as "stressed groundwater areas" such as the Beaverdam Spring/Creek watershed, and this likely depresses water levels in nearby wells (Hairston *et al*. 1990, p. 7) and springs (Younger 2007, p. 162). Thus, water use restrictions under common law (Chapman and U.S. Forest Service 2005, p. 10) provide minimal overall protection for the species.

Limited protection is provided to the Beaverdam Spring/Creek watershed during any construction in the area from Limestone County construction regulations (*http://www.limestonecounty-al.gov/PDFfiles/Engineering/LimestoneCountySDRegs-Complete.pdf*). Specifically, the regulations state that fill material may not be used to raise land in a floodway that restricts the flow of water and increases flood heights, nor can land within a designated floodway be platted for residential occupancy or building sites (Limestone County, Alabama, Subdivision Regulations section 5-3-11(6)32).

Summary of Factor D

The spring pygmy sunfish and its habitat are afforded limited protection from surface water quality and habitat degradation under Federal, State, and County regulations. Notwithstanding this limited protection, large volumes of groundwater and surface water are continually extracted, and these extractions may eventually threaten the aquifer that supplies water to spring pygmy sunfish habitat. Degradation of habitat within the current range of this species continues despite the protections afforded by these existing laws. Therefore, based on the best scientific and commercial data available, we conclude that existing regulatory mechanisms are inadequate to reduce or eliminate the threats to the spring pygmy sunfish.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Impediments to migration, connectivity, and gene flow between or within spring systems are threats to maintaining genetic diversity in the spring pygmy sunfish. Habitat connectivity is critical to maintaining heterozygosity (genetic diversity) within populations of the species and reducing inbreeding, thereby maintaining the integrity of the population (Hallerman 2003, pp. 363-364). Connectivity of spring pygmy sunfish habitats is also necessary for improvement in desired aquatic vegetation, water quality through flushing and diluting pollutants and increasing water quantity, and linking spring segments together. Connectivity maintains water flow between Beaverdam Spring/Creek habitats and allows for potential colonization of unoccupied areas when conditions become favorable for the species and for the necessary aquatic vegetation needed by the species. Localized environmental changes caused by agriculture, urbanization, and other anthropogenic disturbances of the spring systems throughout the watersheds of the Eastern Highland Rim have exacerbated fragmentation of spring habitat (Sandel 2008, pp. 2-4, 13; 2011, pp. 3-6) and reduced the desired vegetation necessary for the species' survival and recovery. Over time, this fragmentation of the spring pygmy sunfish's habitat will impose negative selective pressures on the species' populations, such as genetic isolation; reduction of space for rearing, recruitment, and reproduction; reduction of adaptive capabilities; and increased likelihood of local extinctions (Burkhead *et al*. 1997, pp. 397-399; Sandel 2011, pp. 8-10). The Tuscumbia darter (*E. tuscumbia*), a species found in the Beaverdam Creek/Spring system that also exhibits metapopulation dynamics, has been impacted by fragmentation and cessation of inter-spring migration pathways, similar to the spring pygmy sunfish (Fluker *et al.* 2007, pp. 6-8). Impoundments (Pickwick Reservoir) now block both species' migration pathways, and isolated populations have experienced genetic bottlenecks (the genetic variation within a population and the potential to adapt to a changing environment decrease) (Fluker *et al.* 2007, pp. 6-8).

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions (for these and other examples, see IPCC 2007, p. 30; Solomon *et al.* 2007, pp. 35–54, 82–85).

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of greenhouse gas (GHG) emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl *et al.* 2007, entire; Ganguly *et al.* 2009, pp. 11555, 15558; Prinn *et al.* 2011, pp. 527, 529). Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007, pp.

44–45; Meehl *et al.* 2007, pp. 760–764 and 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529).

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19).

While we do not have specific information concerning the effect of climate change on spring pygmy sunfish and its habitat, we do know that climate affects groundwater budgets (inflow and outflow) by influencing precipitation and evaporation and, therefore, the rates and distribution of recharge of the aquifer. Climate also affects human demands for groundwater and affects plant transpiration from shallow groundwater in response to solar energy and changing depths to the water table (Likens 2009, p. 91). Chronic regional drought between 2000 and 2005 within the Tennessee Valley decreased rates of surface water flow and aquifer recharge. Water extraction (both groundwater and surface water) during drought periods exacerbated damage to the spring pygmy sunfish and its habitat (Sandel 2009, p. 15). Even though aquifers in the region are not depleted but are sometimes seasonally low, especially during drought periods, drought has affected Beaverdam Spring/Creek since records were kept. The 1954 drought was more extreme than the 2007 drought (USGS Water-Supply Paper 2375, pp. 163-170, *http://md.water.usgs.gov/publications/wsp-2375/al*; Seager *et al*. 2009, pp. 5042-5043). Monthly normal temperatures for 1981-2010 show an increase by

1.8 °F and precipitation has decreased by 3.17 in per year (National Weather Service Forecast Office, Huntsville, Alabama 2011, *http://www.srh.noaa.gov/hun*).

Long-term droughts impact groundwater by increasing groundwater extraction for public consumption and agriculture, which in turn do not replenish surface waters (Likens 2009, p. 91). The assessment of long-term impacts of projected changes in climate, population, and land use and land cover on regional water resources is critical to sustainable development, especially in the southeastern United States (Sun *et al.* 2008, pp. 1141-1157). Across the southern United States, changes in climate had the greatest impacts on water stress, followed by population, and land use (Sun *et al.* 2008, pp. 1141-1157). The prolonged drought within northern Alabama during 2006 to 2008 was exceptional (Jandebeur 2012d, p. 13), and along with the severe drought of 1950 to 1963 (Jandebeur 2012d, p. 13), may have contributed to the demise of the Pryor Spring/Branch population of the spring pygmy sunfish in 2008, by increasing toxic concentrations of herbicides and by increasing the desiccation of aquatic vegetation.

Conservation Efforts to Reduce or Eliminate Other Natural or Manmade Factors Affecting Its Continued Existence

The signed CCAA with Belle Mina Farms, Ltd. and the two proposed CCAAs, will likely reduce some of the threats to groundwater caused by climate change by minimizing impacts and helping to maintain groundwater recharge of the aquifer, protecting surface water flow, and limiting groundwater extraction. Under the signed

CCAA, the Service will provide technical assistance and groundwater management advice. Additionally, adaptive management measures of this CCAA concern groundwater usage, including pumping from the aquifer and avoidance of temporary or permanent groundwater removal installations. Also under this CCAA, the landowners will not engage in practices, such as pesticide and herbicide use, stock farm ponds, and aquaculture, within the designated protected areas that may disturb water quality during low water levels associated with drought periods. Similar conservation measures are outlined in the two proposed CCAAs. The conservation measures in the signed and proposed CCAAs will help protect the species on these properties in the near term and also minimize any incidental take of the species that might occur as a result of conducting other covered activities now that we are listing the species under the Act. However, because of anthropogenic factors such as urbanization or intensive agriculture, these conservation measures may be inadequate during drought periods caused by climate change or other natural phenomena.

Summary of Factor E

Habitat fragmentation and its resulting effects on gene flow and potential demographic impacts within the population is a substantial threat to the spring pygmy sunfish. Increasing drought associated with climate change affects groundwater budgets (inflow and outflow) by influencing the rates and distribution of recharge of the aquifer, affects human demands for groundwater and surface water, and affects plant transpiration from shallow groundwater reserves. Based on the best available scientific and commercial data, we conclude that the spring pygmy sunfish faces threats from other natural or manmade factors affecting its continued existence. These threats continue, even though they are possibly lessened by the beneficial effects of the signed CCAA and the two proposed CCAAs.

Determination

We have carefully assessed the best scientific and commercial data available regarding the past, present, and future threats faced to the spring pygmy sunfish. The identified threats to the spring pygmy sunfish fall under Factors A, D, and E, as described in more detail in the **Summary of Factors Affecting the Species** section, above. Habitat modification (Factor A) is the primary threat to the species. This is due to ongoing threats associated with ground and surface water withdrawal and water quality within the spring systems where this species currently occurs and historically occurred. In the future, these current threats will likely be coupled with impacts from planned urban and industrial development of land adjacent to spring pygmy sunfish habitat and the resultant impacts to the spring system and surrounding aquifer recharge area. We find that this planned increase in urban and industrial development and associated infrastructure, along with the potential unsustainable use of the area, is a threat to the spring pygmy sunfish, with the potential to exacerbate direct mortality as well as permanent loss, fragmentation, or alteration of its habitat. The degradation of habitat throughout the species' range continues despite the protections afforded by existing Federal and State laws and policies (Factor D). Habitat fragmentation and its resulting effects on gene flow and potential demographic impacts within the population is a threat (Factor E) that affects the spring pygmy sunfish's continued existence. These threats are rangewide and expected to increase in the future.

The established Belle Mina Farms CCAA provides a measure of protection for the species in the upper reach of the population (24 percent of species' occupied habitat), with the implementation of conservation measures that increase or preserve water quantity, reduce water quality degradation, and prohibit any potentially damaging land use actions in that area (Factor A). In addition, a portion of the recharge area for the Beaverdam Spring/Creek is provided a measure of protection from impervious substrate and excessive storm water runoff under this CCAA since the 1,011 ac of enrolled lands are to be maintained in their present condition, which is mostly agriculture. Currently, conservation measures or protection extends to the portion of the species' habitat currently enrolled in the CCAA (24 percent) and to the lower 57 percent of the habitat in Federal ownership within the Wheeler NWR (although habitat here is of poorer quality). The current CCAA and Federal ownership of a portion of the habitat reduce many of the threats (under Factors A and E) within the immediate core of the species' current range; however, these protections are not able to ameliorate all of the threats to the species and its habitat, most notably impacts associated with the large-scale industrial and residential development planned in the area, which has potential to impact the hydrology and water quality of the spring system.

We note that the two proposed CCAAs, if finalized, would provide additional conservation benefit to the species in the middle portion of its range. However, we have determined that the additional conservation actions in the proposed CCAAs do not remove the threats to the species and its habitat to the point that listing is not necessary, especially when considering probable and potential impacts from planned residential and industrial development (Factor A). Therefore, the possible final approval of the proposed CCAAs following the public comment period would not change our determination to list the spring pygmy sunfish as a threatened species.

The Act defines an endangered species as any species that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. We find that the spring pygmy sunfish is likely to become endangered throughout all or a significant portion of its range within the foreseeable future, based on the immediacy, severity, and scope of the ongoing threats, expected future threats, and taking into considerations the protections afforded to the species by the Belle Mina Farms CCAA. Therefore, on the basis of the best available scientific and commercial data, we are listing the spring pygmy sunfish as threatened in accordance with sections 3(20) and 4(a)(1) of the Act. We find that endangered species status is not appropriate for the spring pygmy sunfish because: (1) Protections afforded by the CCAA help reduce some of the current threats to the species; and (2) many of the threats facing the species from planned industrial and residential development are likely to occur in the future. Therefore, the spring pygmy sunfish is not in danger of extinction.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The threats to the survival of the species occur throughout the species' range and are not restricted to any particular significant portion of that range. Accordingly, our assessment and determination applies to the species throughout its entire range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species.

The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan identifies site-specific management actions that set a trigger for review of the five factors that control whether a species remains endangered or may be downlisted or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (comprised of species experts, Federal and State agencies, nongovernment organizations, and stakeholders) are often established to develop recovery plans. When completed, the draft and final recovery plans will be available on our website (*http://www.fws.gov/endangered*) or from our Mississippi Ecological Services Field Office (see **ADDRESSES**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribal, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

The CCAA between the Service, Belle Mina Farms Ltd., and the Land Trust identifies several strategies that will support recovery efforts, including: (1) Maintenance of vegetation buffer zones along the springs; (2) prohibition of cattle within the spring; (3) prohibition of deforestation, land clearing, industrial development, residential development, aquaculture, temporary or permanent ground water removal installations, stocked farm ponds, pesticide and herbicide use, and impervious surface installation within the protected area of the CCAA; and (4) establishment of a biological monitoring program for the spring pygmy sunfish and its habitat. Similar conservation actions are outlined in the two proposed CCAAs.

When this species is listed (see **DATES**), funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, under section 6 of the Act, the State of Alabama will be eligible for Federal funds to implement management actions that promote the protection and recovery of the spring pygmy sunfish. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants*.

Please let us know if you are interested in participating in recovery efforts for the spring pygmy sunfish. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Federal agency actions within the species' habitat that may require consultation as described in the preceding paragraph include management and any other landscape-altering activities on Federal Lands administered by the U.S. Fish and Wildlife Service. Federal activities that may affect spring pygmy sunfish, include, but are not limited to: The carrying out, funding, or the issuance of permits for discharging fill material on wetlands for road or highway construction; installation of utility easements; development of residential, industrial, and commercial facilities; channeling or other stream geomorphic changes; discharge of contaminated or sediment-laden waters; wastewater facility development; and excessive groundwater and surface water extraction.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered wildlife. The prohibitions of section 9(a)(1) of the Act, and its implementing regulations at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. The regulations at 50 CFR 17.31 extend the prohibitions listed above to threatened species, with certain exceptions. Under the Lacey Act (18 U.S.C. 42-43; 16 U.S.C. 3371-3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 for endangered species, and at 17.32 for threatened species. With regard to endangered wildlife, a permit must be issued for take for the following purposes: for scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a listing on proposed and ongoing activities within the range of the listed species. The following activities could potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized collecting, handling, possessing, selling, delivering, carrying, or transporting of the species, including import or export across State lines and international boundaries, except for properly documented antique specimens of these taxa at least 100 years old, as defined by section 10(h)(1) of the Act;

(2) Introduction of species that compete with or prey upon the spring pygmy sunfish;

(3) The unauthorized release of biological control agents that attack this species' habitat or any of its life stages;

(4) Unauthorized modification of the vegetation composition or hydrology, or violation of any discharge or water withdrawal permit that results in harm or death to any individuals of this species or that results in degradation of its occupied habitat to an extent that essential behaviors such as breeding, feeding, and sheltering are impaired;

(5) Unauthorized destruction or alteration of the species' habitat (such as channelization, dredging, sloping, removing of substrate, or discharge of fill material) that impairs essential behaviors, such as breeding, feeding, or sheltering, or that results in killing or injuring spring pygmy sunfish; and

(6) Unauthorized discharges or dumping of toxic chemicals or other pollutants into the aquifer directly through wells or into the spring system or indirectly into recharge areas supporting spring pygmy sunfish that kills or injures the species or that otherwise impairs essential life-sustaining requirements, such as breeding, feeding, or sheltering (destruction of vegetation and substrate).

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Mississippi Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**). Requests for copies of the regulations concerning listed animals and general inquiries regarding prohibitions and permits may be addressed to the U.S. Fish and Wildlife Service, Endangered Species Permits, 1875 Century Blvd. NE., Atlanta, GA 30345 (telephone 404-679-7313; facsimile 404-679-7081).

Under section 4(d) of the Act, the Secretary has discretion to issue such regulations as she deems necessary and advisable to provide for the conservation of threatened species. Our implementing regulations (50 CFR 17.31) for threatened wildlife generally incorporate the prohibitions of section 9 of the Act for endangered wildlife, except when a "special rule" promulgated pursuant to section 4(d) of the Act has been issued with respect to a particular threatened species. In such a case, the general prohibitions in 50 CFR 17.31 would not apply to that species, and instead, the special rule would define the specific take prohibitions and exceptions that would apply for that particular threatened species, which we consider necessary and advisable to conserve the species. The Secretary also has the discretion to prohibit by regulation with respect to a threatened species any act prohibited by section 9(a)(1) of the Act. Exercising this discretion, which has been delegated to the Service by the Secretary, the Service has developed general prohibitions that are appropriate for most threatened species in 50 CFR 17.31 and exceptions to those prohibitions in 50 CFR 17.32. We are not promulgating a section 4(d) special rule at this time, and as a result, all of the section 9 prohibitions, including the "take" prohibitions, will apply to the spring pygmy sunfish.

Rationale for a 60-day Effective Date

We have published a notice of availability in the **Federal Register** for public review and comment on the two proposed CCAAs, associated permit applications and draft environmental action statements. It is our intention to make a final determination on the proposed CCAAs before this rule becomes effective; however, we are not certain that this can be accomplished within 30 days after the issuance of this rule. Therefore, the effective date of the rule is 60 days from the publication date of this final rule (see **DATES**), rather than our typical 30 days, to provide adequate time for the public to review and comment on the two proposed CCAAs.

Required Determinations

National Environmental Policy Act

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or threatened species under the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

References Cited

A complete list of all references cited in this rule is available on the Internet at *http://www.regulations.gov* or upon request from the Field Supervisor, Mississippi Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this final rule are the staff members of the Mississippi Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as follows:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361-1407; 1531-1544; 4201-4245, unless otherwise noted.

2. Amend §17.11(h) by adding an entry for “Sunfish, spring pygmy” to the List of Endangered and Threatened Wildlife in alphabetical order under FISHES to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
* * * * * * *							
FISHES							
* * * * * * *							
Sunfish, spring pygmy	*Elassoma alabamae*	U.S.A. (AL)	Entire	T	827	NA	NA
* * * * * * *							

* * * * *

Dated: ___September 20, 2013.______________________________

Signed: __Rowan Gould,___________________________

(Acting) Director, U.S. Fish and Wildlife Service.

~~[Endangered and Threatened Wildlife and Plants; Threatened Status for the Spring Pygmy Sunfish]~~

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