United States contains, at most, less than 1 percent of the worldwide jaguar habitat, and has no resident population of jaguars (Rosemont 2020, p. 9). This information relates to the status of the species and does not address whether or not Unit 3 allows for the normal demographic function and possible range expansion of the Northwestern Recovery Unit. The petition also states that removal of the northern Santa Rita Mountains and Subunit 4b represents a very small percentage of the total critical habitat—about 6.5 percent—that would be removed by the petitioned action and will not prevent the remaining critical habitat from functioning as intended for the support of the Northwest Recovery Unit (Rosemont 2020, pp. 13–14). The recovery function and value of critical habitat for the jaguar within the United States is to contribute to the species' persistence and, therefore, overall conservation by identifying areas that support some individuals during dispersal movements, that contain small patches of habitat (perhaps in some cases with a few resident jaguars), and that allow for cyclic expansion and contraction of the nearest core area and breeding population in the Northwestern Recovery Unit (79 FR 12572, March 5, 2014, p. 79 FR 12574). Removal of the northern Santa Rita Mountains would withdraw areas that currently provide the physical and biological features of jaguar critical habitat and in which confirmed jaguar detections occurred between 2012 and 2015 (U.S. Fish and Wildlife Service 2016, p. 295). In addition, removal of Subunit 4b eliminates half of the available connections to Mexico for Unit 4 (specifically to Subunit 4a), which is a unit in which the same jaguar that occupied the Santa Rita Mountains (Unit 3) was detected in 2011. The petition does not explain why these areas are no longer essential other than to assert that most critical habitat units would be unaffected, and that impacts to Unit 3 and Unit 4 would be minor and would not prevent the units from functioning as intended. This assertion does not demonstrate that changes have occurred to these areas such that the function they provide to jaguars, and the reason for which they were designated as critical habitat, is compromised. Therefore, the petition does not provide substantial scientific information that the northern Santa Rita Mountains in Unit 3 and all of Subunit 4b no longer function as critical habitat and are not essential in allowing for the normal demographic function and possible range expansion of the Northwestern Recovery Unit.

The petition discusses the 2013 biological opinion for the Rosemont Copper Mine, which was overturned by a court decision (*Ctr. for Biological Diversity* at 873), and our 2019 amendments to the regulations at 50 CFR 424.12 in its request to revise critical habitat for jaguars. We reviewed the petition's argument and find that these documents are not relevant to the question of whether the petition contained substantial information to support the removal of areas from critical habitat. Neither line of discussion speaks to whether the areas petitioned for removal contain the physical or biological features essential to the conservation of the species or provides information that these features do not require special management considerations or protection (50 CFR 424.14(e)(4).

Based on our review of the petition and sources cited in the petition, we find that the petition does not present substantial scientific or commercial information indicating the petitioned action may be warranted for the jaguar. Because the petition does not present substantial information indicating that revision of critical habitat for jaguar may be warranted, we do not intend to proceed with any such revision. However, we ask that the public submit to us any new information that becomes available concerning this species' habitat at any time by contacting the person listed under **FOR FURTHER INFORMATION CONTACT**, above.

References Cited

A complete list of references cited in this document is available on the internet at *http://www.regulations.gov* and upon request from the Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this document are the staff members of the Arizona Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Martha Williams,

Principal Deputy Director, Exercising the Delegated Authority of the Director, U.S. Fish and Wildlife Service.

[FR Doc. 2021–19062 Filed 9–3–21; 8:45 am]

BILLING CODE 4333–15–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2021–0092; FF09E21000 FXES11110900000 212]

RIN 1018–BF43

Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Pyramid Pigtoe

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce our 12-month finding on a petition to list the pyramid pigtoe *(Pleurobema rubrum),* a freshwater mussel species from Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Ohio, Oklahoma, Tennessee, and Virginia, as an endangered or threatened species under the Endangered Species Act of 1973, as amended (Act). After a review of the best available scientific and commercial information, we find that listing the species is warranted. Accordingly, we propose to list the pyramid pigtoe as a threatened species with a rule issued under section 4(d) of the Act (''4(d) rule''). If we finalize this rule as proposed, it would add this species to the List of Endangered and Threatened Wildlife and extend the Act's protections to the species.

DATES: We will accept comments received or postmarked on or before November 8, 2021. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by October 22, 2021.

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: *http://www.regulations.gov.* In the Search box, enter the docket number or RIN for this rulemaking (presented above in the document headings). For best results, do not copy and paste either number; instead, type the docket number or RIN into the Search box using hyphens. Then, click on the Search button. On the resulting page, in the panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may

submit a comment by clicking on ''Comment.''

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn: FWS–R4–ES–2021–0092, U.S. Fish and Wildlife Service, MS: PRB/3W, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov.* This generally means that we will post any personal information you provide us (see Information Requested, below, for more information).

FOR FURTHER INFORMATION CONTACT: Janet Mizzi, Field Supervisor, U.S. Fish and Wildlife Service, Asheville Ecological Services Field Office, 160 Zillicoa St, Asheville, NC 28801; telephone 828–258–3939. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*), if we determine that a species is an endangered or threatened species throughout all or a significant portion of its range, we are required to promptly publish a proposal in the **Federal Register** and make a determination on our proposal within 1 year, unless, due to substantial disagreement regarding the sufficiency or accuracy of the available data, we extend the 1-year period for no more than 6 months to solicit additional data. To the maximum extent prudent and determinable, we must designate critical habitat for any species that we determine to be an endangered or threatened species under the Act. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

What this document does. We propose to list the pyramid pigtoe as a threatened species with a rule under section 4(d) of the Act. If made final, this action would add the species to the List of Endangered and Threatened Wildlife in title 50 of the Code of Federal Regulations (CFR) at 50 CFR 17.11(h) and add specific provisions pertaining to the pyramid pigtoe to 50 CFR 17.45.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of 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 threats to the pyramid pigtoe include habitat degradation or loss from a variety of sources (*e.g.,* dams and other barriers, resource extraction); degraded water quality from chemical contamination and erosion from development, agriculture, and mining operations; direct mortality from dredging; residual impacts (reduced population size) from historical harvest; and the proliferation of invasive, nonnative species. These threats also compound the negative effects associated with the species' small population size.

Section 4(a)(3) of the Act requires the Secretary of the Interior (Secretary) to designate critical habitat concurrent with listing to the maximum extent prudent and determinable. Section 3(5)(A) of the Act defines critical habitat as (i) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protections; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination by the Secretary that such areas are essential for the conservation of the species. Section 4(b)(2) of the Act states that the Secretary must make the designation on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impacts of specifying any particular area as critical habitat. Critical habitat is not currently determinable. However, critical habitat is prudent, and we intend to propose critical habitat for the species within 1 year of publishing this rule, after acquiring the information to determine the areas warranting critical habitat designation.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other governmental agencies, Native American Tribes, the scientific community, industry, or any other interested parties concerning this proposed rule.

We particularly seek comments concerning:

(1) The species' biology, range, and population trends, including:

(a) Biological or ecological requirements of the species, including habitat requirements for feeding, breeding, and sheltering;

(b) Genetics and taxonomy;

(c) Historical and current range, including distribution patterns;

(d) Historical and current population levels, and current and projected trends; and

(e) Past and ongoing conservation measures for the species, its habitat, or both.

(2) Factors that may affect the continued existence of the species, which may include habitat modification or destruction, overutilization, disease, predation, the inadequacy of existing regulatory mechanisms, or other natural or manmade factors.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to this species and existing regulations that may be addressing those threats.

(4) Additional information concerning the historical and current status, range, distribution, and population size of this species, including the locations of any additional populations of this species.

(5) Information on regulations that are necessary and advisable to provide for the conservation of the pyramid pigtoe and that the Service can consider in developing a 4(d) rule for the species. In particular, information concerning the extent to which we should include any of the section 9 prohibitions in the 4(d) rule or whether we should consider any additional exceptions from the prohibitions in the 4(d) rule.

(6) Which areas would be appropriate as critical habitat for the species and why areas should or should not be proposed for designation as critical habitat in the future.

(7) Specific information on:

(a) The amount and distribution of habitat for pyramid pigtoe that should be considered for proposed critical habitat;

(b) What may constitute ''physical or biological features essential to the conservation of the species within the geographical range currently occupied by the species'';

(c) Where these features are currently found;

(d) Whether any of these features may require special management considerations or practices;

(e) What areas that are currently occupied and contain features essential to the conservation of the species should be included in the designation and why; and

(f) What unoccupied areas are essential for the conservation of the species and why.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made ''solely on the basis of the best scientific and commercial data available.''

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *http://www.regulations.gov,* your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov.*

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov.*

Because we will consider all comments and information we receive during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that the species is endangered instead of threatened, or we may conclude that the species does not warrant listing as either an endangered species or a threatened species. In addition, we may change the parameters of the prohibitions or the exceptions to those prohibitions in the 4(d) rule if we conclude it is appropriate in light of comments and new information received. For example, we may expand the prohibitions to include prohibiting take associated with additional activities if we conclude that those additional activities are not compatible with conservation of the species. Conversely, we may establish additional exceptions to the prohibitions in the final rule if we conclude that the activities would facilitate or are compatible with the conservation and recovery of the species.

Public Hearing

Section 4(b)(5) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing. For the immediate future, we will provide these public hearings using webinars that will be announced on the Service's website, in addition to the **Federal Register**. The use of these virtual public hearings is consistent with our regulations at 50 CFR 424.16(c)(3).

Previous Federal Actions

In our 1989 Animal Notice of Review (a notice identifying animal taxa that are native to the United States and being considered for addition to the List of Endangered and Threatened Wildlife), we categorized the pyramid pigtoe (which we referred to as ''pink pigtoe'') as a taxon not meeting the Act's legal definition of a species, based on our taxonomic understanding of information in published scientific literature at that time (54 FR 554, January 6, 1989). While taxonomic uncertainty remains regarding some populations identified as pyramid pigtoe, the species is recognized as valid in current scientific literature (see Background, below). On April 20, 2010, we received a petition from the Center for Biological Diversity (CBD), Alabama Rivers Alliance, Clinch Coalition, Dogwood Alliance, Gulf Restoration Network, Tennessee Forests Council, and West Virginia Highlands Conservancy to list 404 aquatic, riparian, and wetland species, including the pyramid pigtoe (referred to as ''pink pigtoe'' in our National Domestic Listing Workplan) as endangered or threatened species under the Act. On September 27, 2011, we published our determination that the petition contained substantial information indicating listing may be warranted (76 FR 59836). On April 17, 2019, CBD filed a complaint challenging the Service's failure to complete 12-month findings for these species within the statutory deadline. The Service and CBD reached a stipulated settlement agreement whereby the Service agreed to deliver a 12-month finding for the pyramid pigtoe to the Office of the Federal Register by August 31, 2021.

Supporting Documents

A species status assessment (SSA) team prepared an SSA report for the pyramid pigtoe. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of three appropriate specialists regarding the SSA. We received two responses. We also received SSA report reviews from one Federal agency and five State agency partners, including scientists with expertise in aquatic ecology, freshwater mussel biology, taxonomy, and conservation. In addition, more than 50 individuals at Federal or State agencies, colleges or universities, or consultants provided data used in the SSA report.

I. Proposed Listing Determination

Background

A thorough review of the taxonomy, life history, and ecology of the pyramid pigtoe *(Pleurobema rubrum)* is presented in the SSA report (version 1.0; Service 2021, pp. 19–36).

The pyramid pigtoe is a freshwater mussel, reddish to chestnut brown in color, with a smooth periostracum (outer shell surface) that darkens with age (Watters et al. 2009, p. 233). Juveniles may have green rays that typically disappear with age. The shell is thick, triangular, and medium-sized (up to 3.6 inches (in) (91 millimeters (mm)) (Williams et al. 2008, p. 564). It has a shallow sulcus (depressed channel) and high anteriorly directed beak that is elevated above the hinge line (Stansbery 1967, p. 3).

The pyramid pigtoe is found in medium to large rivers, in a mixture of sand, gravel, and cobble substrates. It currently occurs in Kentucky, Tennessee, Virginia, Ohio, Alabama, Oklahoma, Arkansas, Mississippi, and Louisiana. It is considered extirpated from Pennsylvania, West Virginia, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Kansas, and Missouri. Extant populations of pyramid pigtoe occur in

the Arkansas-White-Red, Lower Mississippi, Missouri, and Ohio River regions (Hydrologic Unit Code 2 scale, Seaber et al. 1987, pp. 3–4), and it is extirpated from the Missouri and Upper Mississippi River regions (Figure 1).

Relying on fish hosts for successful reproduction, the pyramid pigtoe has a complex life cycle similar to other mussels. In general, mussels are either male or female, but differences between sexes in shell shape are subtle (Haag 2012, p. 54). Males release sperm into the water column, which is taken in by the female through the incurrent aperture, where water enters the mantle cavity. The sperm fertilize eggs in the suprabranchial chamber (located above the gills) as ova are passed from the gonad to the marsupia (Yokley 1972, p. 357). Developing larvae remain in the gill chamber until they mature (called glochidia) and are ready for release. Once released, the glochidia draw nutrients from fish hosts and develop into juvenile mussels, dropping from the hosts weeks to months after initial attachment. Only a few glochidia reach the free-living juvenile stage, and mortality rates for the glochidial stage have been estimated at 99 percent, making this a critical phase in the life history of freshwater mussels (Jansen et al. 2001, p. 211).

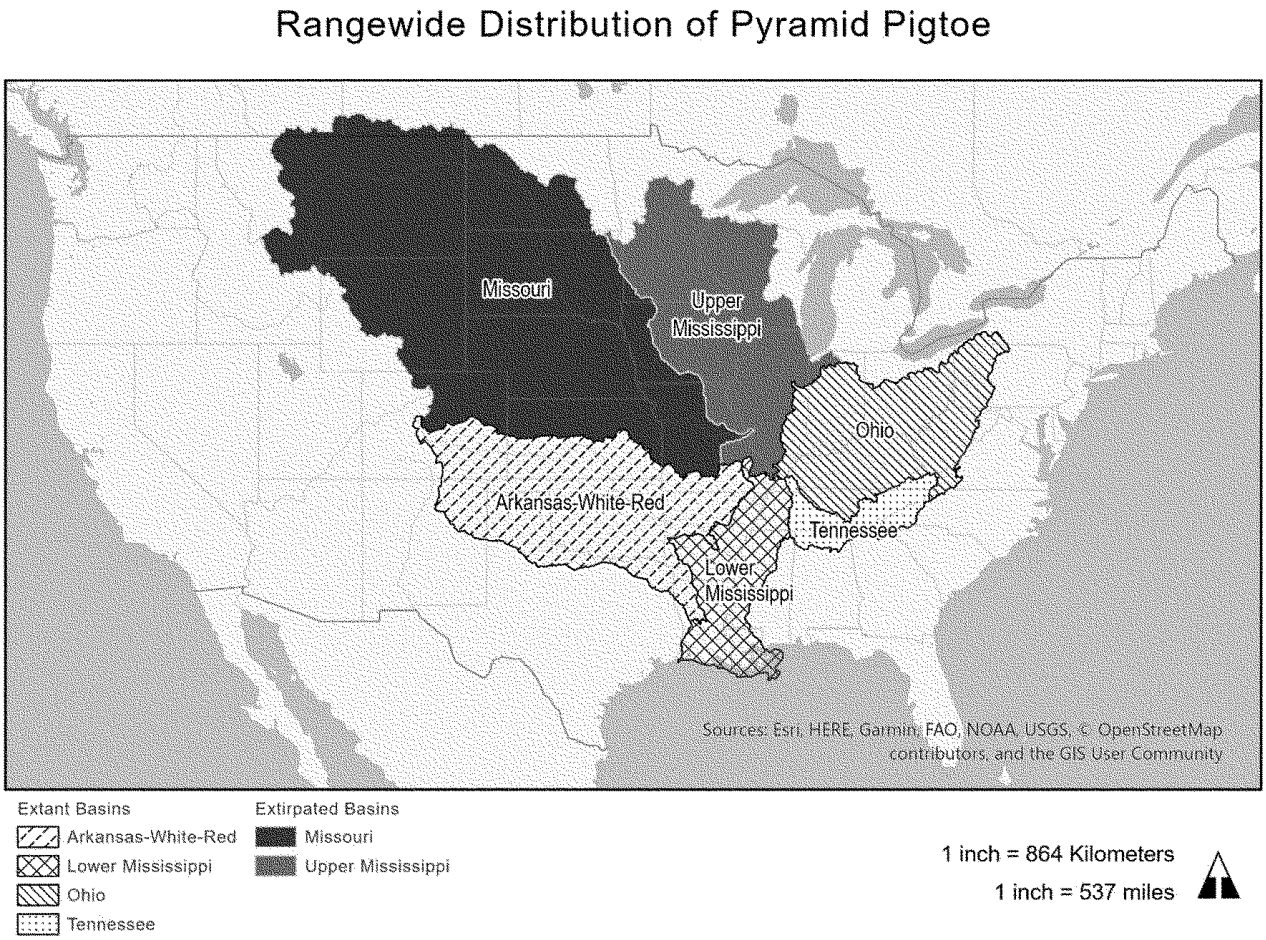

Figure 1. Rangewide distribution of pyramid pigtoe.

The pyramid pigtoe is a short-term brooder and has been recorded as gravid in the Cumberland River in May, June, and July (Gordon and Layzer 1989, p. 50). Host fish species are minnows of the family Cyprinidae and genera *Cyprinella, Erimystax, Lythrurus,* and *Notropis* (Culp et al. 2009, p. 19). Similar to other species in its tribe, Pleurobemini (taxonomic rank above genus and below family), the pyramid pigtoe targets drift-feeding minnow species by releasing glochidia contained in packets called conglutinates (Haag 2012, p. 163). Following release from the female mussel, the semi-buoyant conglutinates drift in the water column where they are targeted by sight-feeding minnows (Culp *et al,* 2009, p. 21).

A relatively long-lived species, the pyramid pigtoe has a lifespan that likely averages 20 to 30 years, based on observations of the closely related Ohio pigtoe and round pigtoe (Slater 2018, p. 35; Watters et al. 2009, p. 299). Given the longevity of closely related species, it possibly lives up to 40–45 years in some locations (Ostby and Beaty 2016, p. 117).

The pyramid pigtoe exhibits a preference for sand and gravel in rivers but also may be found in coarse sand in larger rivers (Gordon and Layzer 1989, p. 31). They can be found at depths less than 3 ft (1 m) but in large rivers can be found commonly at depths of 13 to

20 ft (4 to 6 m) or greater (Parmalee and Bogan 1998, p. 193; Williams et al. 2008, p. 566). Adult freshwater mussels within the genus *Pleurobema* are suspension-feeders that filter water and nutrients to eat. Mussels may shift to deposit feeding, though reasons for this are poorly known and may depend on flow conditions or temperature. Their diet consists of a mixture of algae, bacteria, detritus, and microscopic animals (Gatenby et al. 1996, p. 606; Strayer et al. 2004, p. 430). It has also been surmised that dissolved organic matter may be a significant source of nutrition (Strayer et al. 2004, p. 431).

The pyramid pigtoe *(Pleurobema rubrum)* belongs to a complex of four morphologically similar species, which includes the Ohio pigtoe (*P. cordatum*), rough pigtoe (*P. plenum*) and round pigtoe (*P. sintoxia*). Since its original description as a species (Rafinesque 1820, p. 314), *Pleurobema rubrum* has undergone several scientific name changes, due to its widespread distribution, variability in shell shape and size throughout its range, and similarity in morphological characters to other closely related species. Additionally, based on shell characters alone, the pyramid pigtoe has been periodically considered a subspecies of the Ohio pigtoe (Ortmann 1911, p. 331). Since its initial description in 1820, the pyramid pigtoe has sometimes been referred to as pink pigtoe by commercial shell harvesters and biologists. However, the common name applied to the species in the scientific literature and in the Integrated Taxonomic Information System is pyramid pigtoe.

Genetic studies to clarify the taxonomic relationships among *Pleurobema* indicate potential differences between pyramid pigtoe populations occupying separate river drainages. Mitochondrial DNA samples from two specimens of pyramid pigtoe indicated the Duck River, Tennessee, specimen was genetically distinct from the St. Francis River, Arkansas, specimen (Campbell et al. 2005, p. 143). These same data were included in subsequent phylogenetic studies focused on *Fusconaia* (Burdick and White 2007, p. 372) and *Pleurobema* (Campbell et al. 2008, p. 714; Campbell and Lydeard 2012b, p. 27) with similar results. Phylogeographic structuring has been observed between pyramid pigtoe from the Ouachita and St. Francis drainages in Arkansas that may represent species-level variation (Christian et al. 2008, p. 9; Harris et al. 2009, p. 74). Additionally, an analysis that included all previously published and new data representing a broad sampling across Pleurobemini revealed that pyramid pigtoe and round pigtoe may represent a single species, with two out of three species delineation models indicating one lineage present in specimens identified as round pigtoe and pyramid pigtoe (Inoue et al. 2018, p. 694). However, one of the three models indicated separate lineages of the two species. While there is some uncertainty in the taxonomic identity of populations referred to as pyramid pigtoe, especially those outside the Ohio, Cumberland, and Tennessee basins, our SSA report analyzed the status of the single species currently recognized by the scientific community (Williams et al. 2017, p. 42; Graf and Cummings 2021, p. 19).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an endangered species or a threatened species. The Act defines an endangered species as a species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as a species that is ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether any species is an endangered species or a threatened species because of any of the following 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.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term ''threat'' to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term ''threat'' includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term ''threat'' may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an ''endangered species'' or a ''threatened species.'' In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an ''endangered species'' or a ''threatened species'' only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term ''foreseeable future,'' which appears in the statutory definition of ''threatened species.'' Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term ''foreseeable future'' extends only so far into the future as the Service can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. ''Reliable'' does not mean ''certain''; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-

specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological review of the best scientific and commercial data regarding the status of the species, including an assessment of the potential threats to the species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as an endangered or threatened species under the Act. However, it does provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket FWS–R4–ES–2021–0092 on *http://www.regulations.gov* and at *https://www.fws.gov/Asheville/.*

To assess pyramid pigtoe viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. Throughout all of these stages, we used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability.

Species Needs

We assessed the best available information to identify the physical and biological needs to support individual fitness at all life stages for the pyramid pigtoe. Full descriptions of all needs are available in chapter 4 of the SSA report (Service 2021, pp. 29–36), which can be found in docket number FWS–R4–ES–2021–0092 on *http://www.regulations.gov,* and on our internet site *https://www.fws.gov/Asheville/.* To maintain viability, individual pyramid pigtoes need clean flowing water, appropriate water quality and temperatures (parameters listed in Service 2021, p. 29), low levels of sedimentation, and food and nutrients. Pyramid pigtoe habitat is in rivers with natural flow regimes. Perturbations that disrupt natural flow patterns (*e.g.,* dams) have a negative influence on pyramid pigtoe and host fish resilience. Pyramid pigtoe habitat must have adequate flow to deliver oxygen, enable passive reproduction, and deliver food.

At the population and species (rangewide) level, the pyramid pigtoe needs habitat connectivity and positive demographic attributes (population density and growth rate, age class structure, recruitment) to maintain viability (Service 2021, pp. 32–33). Dendritic, or branched, orientation of stream systems can enhance metapopulation persistence compared to linear or two-dimensional systems (Fagan 2002, p. 3,243). Tributary connection to river mainstems allows movement of host fishes and helps facilitate dispersal and colonization of appropriate habitat patches by mussels. A high degree of connection between habitat patches and occupied reaches is necessary, because mussels are heavily dependent on gene exchange and host fish movement and dispersal within river corridors to maintain viable populations (Newton et al. 2008, p. 425).

Fragmentation of stream habitat results in barriers to host fish movement, which in turn, influences mussel distributions, increasing the likelihood and compounding the significance of local extirpation events (Fagan 2002, p. 3,248). The pyramid pigtoe and other mussel species that use small host fishes, such as minnows and shiners (family Cyprinidae), are more susceptible to impacts from habitat fragmentation. This is due to increasing distance between suitable habitat patches and low likelihood of small host fish swimming over that distance as compared to large host fishes (Vaughn 2012, p. 7). Barriers to movement can cause isolated or patchy distributions of mussels, which may limit both genetic exchange and recolonization (Jones et al. 2006, p. 528).

Mussel abundance in a given river reach is a product of the number of mussel beds (aggregations of freshwater mussels) and the density of mussels within those beds. Healthy pyramid pigtoe populations have numerous individuals, with multiple age classes, and exhibit regular recruitment of new age classes. For pyramid pigtoe populations to be resilient, there must be multiple mussel beds of sufficient density such that local stochastic events do not eliminate the bed(s), allowing the mussel bed and the overall local population within a river reach to recover from any one event. A dendritic distribution (branching, such that there is not a line connecting a single upstream and downstream aggregation) over a large area also helps buffer against stochastic events that may impact populations. Mussels do not actively seek mates; rather, males release sperm into the water column, where it drifts until a female takes it in (Moles and Layzer 2008, p. 212). Therefore, successful individual reproduction and population viability require sufficient numbers of female mussels downstream of sufficient numbers of male mussels; higher density (number of mussels per unit area) increases the likelihood of fertilization.

Threats

We have determined that past and current threats to the pyramid pigtoe include habitat degradation or loss from a variety of sources (*e.g.,* dams and other barriers, resource extraction); degraded water quality from chemical contamination and erosion from development, agriculture, and mining operations; direct mortality from dredging; residual impacts (reduced population size) from historical harvest; and the proliferation of invasive, nonnative species. Cumulatively, these threats also contribute to the negative

effects associated with the species' small population size in certain areas.

The following discussions include evaluations of three current threats and associated sources that are affecting the pyramid pigtoe and its habitat: (1) Habitat (including water quality) degradation or loss, (2) invasive and nonnative species, and (3) negative effects associated with small population size (Service 2021, pp. 51–83). We also considered impacts from climate change, but found no evidence linking climate change impacts to the current status of the pyramid pigtoe. We note that overutilization (commercial mussel harvest) was a threat historically and likely reduced the size of many populations such that they have not recovered to historical abundance levels, but it is not currently a threat. In addition, potential impacts from disease, parasites, and predation, as well as potential impacts to host species, were evaluated but were found to have minimal effects on viability of the pyramid pigtoe based on current knowledge (Service 2021, pp. 78–79). Although not a widespread threat, disease is likely affecting at least one population of pyramid pigtoe: The Clinch River mussel assemblage, which includes a pyramid pigtoe population, has recently undergone a die-off that is associated with a novel densovirus (Richard et al. 2020, entire). Finally, we also considered effects associated with enigmatic population declines (unexplained die-offs of large numbers of mussels over a short period of time), which have been documented in fresh water river mussel populations since the 1960s; despite speculation and repeated aquatic organism surveys and water quality monitoring, the causes of these events are largely unknown (Haag 2019, p. 43).

Predominant threats affecting each pyramid pigtoe population are listed in Table 1. Based on threat information in the literature or State Wildlife Action Plans, we categorized the threat level as low, moderate, or high depending on their magnitude and immediacy:

- Low—Threats to aquatic fauna far enough removed in time or space that they are currently exerting minimal influence on mussel populations.
- Moderate—Multiple threats linked to negative effects on mussels are present. Some threats currently acting on mussel habitat, reducing resource needs, and limiting recruitment and population growth.
- High—Multiple threats linked to negative effects on mussels are present and have been acting cumulatively on mussel habitat, prohibiting sustained recruitment and population growth.

TABLE 1—CURRENT THREATS AND LEVEL OF THREAT TO THE PYRAMID PIGTOE BY RIVER BASIN AND POPULATION

[Adapted and modified from SSA report, Service 2021, pp. 157–164]

Population	Threat level category	Threats
OHIO RIVER BASIN		
Muskingum River	High	Hydropower development; impoundment; dredging; population isolation; past commercial harvest.
Upper Green River	Low	Impoundment; habitat loss and water quality degradation; resource extraction; past commercial harvest.
Barren River	Moderate	Impoundment; habitat loss and water quality degradation; resource extraction; past commercial harvest.
Middle Green River	Moderate	Impoundment; habitat loss and water quality degradation; resource extraction; past commercial harvest.
Lower Green River	Moderate	Impoundment; habitat loss and water quality degradation; resource extraction; past commercial harvest.
Cumberland River	High	Habitat fragmentation, hypolimnetic discharges.
TENNESSEE RIVER BASIN		
Holston River	High	Habitat fragmentation, hypolimnetic discharges.
Clinch River	Moderate	Development; agricultural activities; dams; overharvest historically; contaminants; resource extraction; degraded water quality; enigmatic die-offs.
Paint Rock River	Low	Habitat loss through channel maintenance (snag removal); habitat fragmentation and population isolation due to impoundment; agriculture.
Tennessee River (Wheeler Reservoir).	High	Impoundment; habitat degradation from flow releases; past commercial harvest.
Tennessee River (Pickwick Reservoir).	High	Impoundment; dredging; navigation impacts; past commercial harvest.
Tennessee River (Kentucky Reservoir).	High	Impoundment; dredging and navigation impacts; agriculture.
Upper Duck River	Moderate	Development; agricultural activities; water quality degradation; impoundments; fragmented populations.
Lower Duck River	Moderate	Development and water quality degradation.
ARKANSAS-WHITE-RED BASIN		
Petit Jean River	Moderate	Agriculture; habitat loss and water quality degradation.
Eleven Point River	Low	Habitat loss and water quality degradation; agricultural effects.
Little River	Moderate	Impoundment, habitat loss, and water quality degradation.
LOWER MISSISSIPPI BASIN		
Lower Black River	Moderate	Agriculture, habitat loss, and water quality degradation.
Lower St. Francis River	High	Agriculture, habitat loss, and water quality degradation.
Tyronza River	High	Agriculture, habitat loss, and water quality degradation.
White River	Moderate	Impoundment, resource extraction, habitat loss, and water quality degradation.

TABLE 1—CURRENT THREATS AND LEVEL OF THREAT TO THE PYRAMID PIGTOE BY RIVER BASIN AND POPULATION—Continued

[Adapted and modified from SSA report, Service 2021, pp. 157–164]

Population	Threat level category	Threats
Upper Ouachita River	Moderate	Impoundment, navigation, habitat loss, and water quality degradation.
Little Missouri River	Moderate	Agriculture, habitat loss, and water quality degradation.
Ouachita River	Moderate	Impoundment, navigation, habitat loss, and water quality degradation.
Upper Saline River	Moderate	Impoundment, navigation; agriculture; resource extraction; habitat loss and water quality degradation.
Lower Saline River	Moderate	Impoundment, navigation, agriculture, resource extraction, habitat loss, and water quality degradation.
Bayou Bartholomew	High	Agriculture, habitat loss and water quality degradation.
Lower Ouachita River	High	Impoundment; navigation; habitat loss and water quality degradation.
Big Sunflower River	High	Agriculture; habitat loss and water quality degradation.
Hushpuckna River	High	Impoundment; agriculture; navigation; habitat loss and water quality degradation.
Bogue Phalia	High	Impoundment; agriculture; navigation; habitat loss and water quality degradation.
Little Sunflower River	High	Impoundment; agriculture; navigation; habitat loss and water quality degradation.
Sunflower River	High	Impoundment; agriculture; navigation; habitat loss and water quality degradation.
Sandy Bayou	High	Impoundment; agriculture; navigation; habitat loss and water quality degradation.
Big Black River	High	Impoundment; agriculture, habitat loss and water quality degradation.

Habitat Degradation or Loss

Development and Urbanization

Development and urbanization activities that may contribute to pyramid pigtoe habitat degradation or loss, including reduced water quality, occur throughout the species' range. The term ''development'' refers to urbanization of the landscape, including (but not limited to) land conversion for residential, commercial, and industrial uses and the accompanying infrastructure. The effects of urbanization may include alterations to water quality, water quantity, and habitat (both in-stream and streamside) (Ren et al. 2003, p. 649; Wilson 2015, p. 424). Urban development can lead to increased variability in streamflow, typically increasing the extent and volume of water entering a stream after a storm and decreasing the time it takes for the water to travel over the land before entering the stream (Giddings et al. 2009, p. 1). Deleterious effects on streams (*i.e.,* water collection on impervious surfaces that rapidly flows into storm drains and local streams), including those that may be occupied by the pyramid pigtoe, include:

- *Water Quantity:* Storm drains deliver large volumes of water to streams much faster than would naturally occur, often resulting in flooding and bank erosion that reshapes the channel and causes substrate instability, resulting in destabilization of bottom sediments. Increased, high-velocity discharges can cause pyramid pigtoe to become stressed, displaced, or killed by fast-moving water and the debris and sediment carried in it.
- *Water Quality:* Pollutants (*e.g.,* gasoline, oil drips, fertilizers) that accumulate on impervious surfaces may be washed directly into streams during storm events thereby directing killing pyramid pigtoe individuals.
- *Water Temperature:* During warm weather, rain that falls on impervious surfaces becomes superheated and can stress or kill pyramid pigtoe individuals when it enters streams.

Water infrastructure to support development, including water supply, reclamation, and wastewater treatment, results in pollution or contaminant discharges to streams. Right of way (ROW) crossings for waterlines and other utility lines also affect stream habitats. Direct impacts from utility crossings include direct exposure or crushing of individuals, sedimentation, and flow disturbance. The most significant cumulative impact involves cleared ROWs that result in direct runoff and increased stream temperature at the crossing locations. Maintenance or clearing of ROWs may entail herbicide applications that subsequently enter streams via stream runoff.

Most populations of pyramid pigtoe in urban areas with large human populations have been diminished or lost. Secondary impacts resulting from development, such as the increased contaminant introduction, stream disturbance caused by impervious surfaces, barrier construction, and forest conversion to other land use types such as agriculture or urban uses are likely acting cumulatively on the species. Increased human population growth projections indicate urban sprawl (a current process) will affect pyramid pigtoe populations in the Tennessee and Ohio basins (Terando et al. 2014, p. 7; Tayyebi et al. 2015, p. 110). In the Upper and Lower Duck River MUs, the species is currently impacted by rapid development encroaching from the city of Nashville and nearby smaller urban areas such as Columbia, TN (TWRA 2016, p. 15). The pyramid pigtoe population in the Muskingum River is downstream of the Tuscarawas River, which has been severely degraded by industrial development that continues to affect water quality (Hoggarth 1994, p. 3; Haefner and Simonson 2018, p. 1).

Threats to the pyramid pigtoe from development are partly mitigated by Federal lands. Several locations where the pyramid pigtoe occurs in water bodies located on or immediately adjacent to Federal lands receive some indirect benefits to viability such as lack of urbanization and land development pressure. These include the Pond Creek Refuge in Arkansas (Arkansas-White-Red basin) as well as Upper Ouachita, Felsenthal, and White River Refuges (Lower Mississippi basin), and Wheeler Refuge (Tennessee Basin) that are adjacent to large rivers where the pyramid pigtoe occurs. Mammoth Cave National Park also provides a level of localized protection against development pressures for the pyramid pigtoe population in the upper Green River, Kentucky (Ohio Basin).

On private lands, the Saline-Caddo-Ouachita Programmatic Safe Harbor Agreement and Candidate Conservation Agreement with Assurances programs are voluntary conservation programs that support ongoing stewardship for imperiled species, including the pyramid pigtoe. Large tracts of private land in the upper Saline and Ouachita River systems adjacent to streams and upland areas are covered under these programs. These lands are mostly upstream of pyramid pigtoe sites

(Service 2015, p. 6) but could have a positive indirect long-term benefit to the species by reducing sediment and pollutant runoff and improving water quality downstream. Some private lands in pyramid pigtoe MUs also are managed for conservation through The Nature Conservancy (TNC) programs in the upper Green River in Kentucky, the upper Clinch/Powell River, Tennessee and Virginia, the Saline River in Arkansas, and the Paint Rock River in Alabama. In these watersheds, TNC has a few riparian inholdings that are protected from developments. In addition, within these watersheds, TNC implements community-based and partner-oriented projects to address aquatic species and instream habitat conservation by restoring and protecting streambanks and riparian zones.

Various small, isolated parcels of State land (*e.g.,* State parks, State forests, wildlife management areas) along MUs where the pyramid pigtoe occurs also provide a conservation benefit as a buffer to development. However, vast tracks of riparian lands in the range of the pyramid pigtoe are privately owned, without conservation programs, and the prevalence of privately owned lands along rivers is comparatively much larger than the species' occurrence on public lands. Limited overlap of the species' range with public lands and private lands with conservation programs diminishes their ability to protect the species, because the habitat protection benefits these lands provide are at significant risk of being negated by detrimental activities upstream or immediately downstream.

Transportation

Transportation-related impacts include both road development and river navigation. Road development increases impervious surfaces as well as land clearing and habitat fragmentation. Roads are generally associated with negative effects on the biotic integrity of aquatic ecosystems, including changes in surface water temperatures and patterns of runoff, sedimentation, adding heavy metals (especially lead), salts, organics, and nutrients to stream systems (Trombulak and Frissell 2000, p. 18).

With regard to river navigation, dredging and channelization activities (as a means of maintaining waterways) have altered riverine habitats nationwide (Ebert 1993, p. 157). Channelization affects many physical characteristics of streams through accelerated erosion, increased bedload, reduced depth, decreased habitat diversity, geomorphic instability, and riparian canopy loss (Hartfield 1993, p. 139). All of these impacts contribute to loss of habitat for the pyramid pigtoe and host fishes. Increases in turbulence, suspended and deposited sediments, and turbidity resulting from river transportation and associated activities may affect mussel feeding and respiration (Aldridge et al. 1987, p. 25). In addition to dredging and channel maintenance, impacts associated with barge traffic, which includes construction of fleeting areas, mooring cells, docking facilities, and propeller wash, also destroy and disrupt mussel habitat (see Miller et al. (1989, pp. 48–49) as an example for disturbance from barges).

Transportation-related impacts across the range of the pyramid pigtoe include (but are not limited to) the following examples:

- Extensive stream channelization and snag removal has severely affected the freshwater mussel fauna and habitat in the Paint Rock River system, including the lower reaches of Estill Fork and Hurricane Creek (Ahlstedt 1995–96, p. 65). Even if active channelization activities are not currently occurring in rivers and streams occupied by the pyramid pigtoe, impacts of past actions can have permanent effects (Haag and Cicerello 2016, p. 60; Hubbard et al. 1993, p. 142; Watters 2000, p. 274).
- Commercial navigation previously took place in the lower Green and Barren Rivers, where navigation dams remain but are not in operation. Past dredging and navigation affected mussel beds in the mainstem Cumberland River, which has the last remaining population of pyramid pigtoe in the Cumberland River system (Hubbs 2012, p. 9).
- Currently, all three of the Tennessee River mainstem pyramid pigtoe MUs are likely affected to some extent by channel maintenance and navigation operations, due to their clustered distribution and proximity to navigation dams.
- Two navigation dams are operated on the Ouachita River, which is maintained by the Corps as a waterway, and affect three MUs.

Contaminants

Contaminants contained in point and non-point discharges can degrade water and substrate quality and adversely impact mussel populations. The effects of contaminants such as metals, chlorine, and ammonia are profound on juvenile mussels (Bartsch et al. 2003, p. 2,566; Augspurger et al. 2003, p. 2,571). Juvenile mussels may readily ingest contaminants bound to sediment particles (Newton and Cope 2007, p. 276). These contaminants also affect mussel glochidia, which are very sensitive to some toxicants (Goudreau et al. 1993, p. 221; Jacobson et al. 1997, p. 2,386; Valenti et al. 2005, p. 1,243). High levels of suspended solids alone (without bound contaminants) can result in mussel reproductive failure or low fertilization rates of long-term brooders, such as species of the genus *Pleurobema* (Gascho-Landis and Stoeckel 2015, p. 229).

Current State regulations regarding pollutants are designed to be protective of aquatic organisms; however, freshwater mussels may be more susceptible to some pollutants than the test organisms commonly used in bioassays. Additionally, water quality criteria may not incorporate data available for freshwater mussels (March et al. 2007, pp. 2,066–2,067). A multitude of bioassays conducted on 16 mussel species (summarized by Augspurger et al. 2007, pp. 2,025–2,028) show that freshwater mollusks are more sensitive than previously believed to some chemical pollutants, including chlorine, ammonia, copper, fungicides, and herbicide surfactants. Nickel and chloride were toxic to federally threatened mussel species at levels below the current criteria and are sensitive to sodium dodecyl sulfate (SDS), a surfactant commonly used in household detergents, for which water quality criteria do not currently exist (Gibson 2015, p. 80, p. 90; Gibson et al. 2018, pp. 247–250). None of the States in the range of the pyramid pigtoe have fully adopted the Environmental Protection Agency's 2013 recommended ammonia criteria for freshwater mollusks (78 FR 52192, August 22, 2013).

Contaminant inputs (including sediments) to pyramid pigtoe habitat stem from multiple threats, including urbanization, resource extraction, agriculture, and channel maintenance for navigation, diminishing water quality in many areas of the four basins where the species occurs. Examples of contaminant-related impacts in the range of the pyramid pigtoe include (but are not limited to) the following:

- Long-term declines and extirpation of mussels from reaches of the Upper Clinch MU in Virginia attributed, in part, to copper and zinc contamination originating from wastewater discharges at coal-fired power plants (Price et al. 2014, p. 12; Zipper et al. 2014, p. 9). Coal plants also are located on the Lower Green and Cumberland-Old Hickory MUs.
- Heavy metals toxicity to mussels has been documented in the

Muskingum, Upper Clinch, and all Tennessee River MUs (Havlik and Marking 1987, pp. 4–9).

• A chemical spill from a tanker truck accident flowed into the Upper Clinch MU in Virginia and eliminated approximately 18,000 individuals of several mussel species (Jones et al. 2001, p. 20; Schmerfeld 2006, p. 12), including approximately 750 individuals of three federally listed species (Schmerfeld 2006, p. 12). A catastrophic chemical spill in 1999 affected approximately 10 miles of the Ohio River and resulted in the loss of an estimated 1 million mussels, including two federally listed species (Butler 2005, p. 24).

State and Federal water quality programs provide a level of protection to the pyramid pigtoe from development, agriculture, and river navigation activities by regulating storm water and point source (end of pipe) discharges to streams. Section 401 of the Federal Clean Water Act (CWA; 33 U.S.C. 1251 *et seq.*) requires that an applicant for a Federal license or permit provide a certification that any discharges from the facility will not degrade water quality or violate water-quality standards, including those established by States. Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill material into waters of the United States. Under the CWA, permits to fill wetlands and culvert, bridge, or realign streams or water features are issued by the U.S. Army Corps of Engineers. Current State regulations regarding pollutants are designed to be protective of aquatic organisms; however, as discussed above, freshwater mussels may be more susceptible to some pollutants than the aquatic biota for which water quality criteria are currently established.

Despite existing authorities such as the CWA, pollutants continue to impair the water quality in areas of the pyramid pigtoe's range. State and Federal regulatory mechanisms have helped reduce the negative effects of point source discharges since the 1970s, yet these regulations are difficult to implement and enforce. Although new water quality criteria are under development that will take into account more sensitive aquatic species, most current criteria do not. It is expected that several years will be needed to implement new water quality criteria throughout the species' range.

Agriculture

Agricultural activities occur across the range of the pyramid pigtoe and are a factor in its historical decline and localized extirpations. The advent of intensive row crop agricultural practices corresponds with freshwater mussel declines, and species extirpations, in the eastern United States (Peacock et al. 2005, p. 550). Nutrient enrichment and water withdrawals, threats commonly associated with agricultural activities, may be localized and limited in scope, and have the potential to affect individual pyramid pigtoe mussels. However, chemical control using pesticides may have broader impacts. Pesticides, including herbicides, fungicides, and insecticides as well as their surfactants and adjuvants, are highly toxic to juvenile and adult freshwater mussels (Bringolf et al. 2007, p. 2,092) and deleterious if not properly applied to agricultural operations. Waste from confined animal feeding and commercial livestock operations is another potential source of contaminants that come from agricultural runoff. The concentrations of these contaminants from fields or pastures may be at levels that can affect an entire population, especially given the highly fragmented distribution of the pyramid pigtoe.

Agencies such as the Natural Resources Conservation Service (NRCS) and the Soil and Water Conservation Districts provide technical and financial assistance to farmers and private landowners. Additionally, county resource development councils and university agricultural extension services disseminate information on the importance of minimizing land use impacts, specifically agriculture, on aquatic resources. These programs help identify opportunities for conservation through projects such as exclusion fencing and alternate water supply sources, which help decrease nutrient inputs and water withdrawals and help keep livestock off stream banks and shorelines, reducing erosion. However, the overall effectiveness of these programs over a large scale is unknown given the pyramid pigtoe's wide distribution and varying agricultural intensities in its range.

Dams and Barriers

Whether for flood control, hydropower, river navigation, or as abandoned mill structures, dams and their impoundments are one of the most pervasive threats to pyramid pigtoe rangewide: 26 of 35 populations and all 4 major basins in the species' range are affected (Table 1). Dams have many impacts on stream ecosystems, and the effects of impoundments and barriers on aquatic habitats and freshwater mussels are relatively well-documented (Watters 2000, p. 261). Extinction and extirpation of many North American freshwater mussels can be traced to impoundment and inundation of riffle habitats in all major river basins of the central and eastern United States (Haag 2009, p. 107). Reductions in the diversity and abundance of mussels are primarily attributed to habitat shifts, alteration and disruption of connectivity, and diminished water quality as a result of reservoir construction (Neves et al. 1997, p. 63). The survival and reproductive success of mussels are influenced upstream of dams as flowing waters change to impounded waters, with increased depths and buildup of sediments, decreased dissolved oxygen, and drastic alteration of resident fish assemblages. Downstream of dams, biotic and physical habitat conditions provided by natural flow regimes are altered by minimal releases or scouring flows, seasonal dissolved oxygen depletion, and reduced or increased water temperatures. The number of fish species is greatly reduced where coldwater flow (hypolimnetic discharge) is released. Additionally, dams fragment habitat, limiting dispersal of mussels on their fish hosts, which leads to genetic isolation of mussel populations.

Resource Extraction

Predominant resource extraction threats in the range of the pyramid pigtoe stem from mining (primarily coal but including other mineral resources) and oil and gas exploration. Activities associated with coal mining and oil and gas drilling can contribute chemical pollutants to streams. Acid mine drainage is created from the oxidation of iron-sulfide minerals such as pyrite, forming sulfuric acid (Sams and Beer 2000, p. 3). This acid mine drainage may be associated with high concentrations of aluminum, manganese, zinc, and other constituents (Tennessee Department of Environment and Conservation (TDEC) 2014, p. 72). The metals, and the high acidity typically associated with acid mine drainage, can be acutely and chronically toxic to aquatic life (Jones 1964, p. 96). Implementation of the Surface Mining Control and Reclamation Act of 1977 (SMCRA; 30 U.S.C. 1201 *et seq.*) has significantly reduced acid mine drainage from new coal mines; however, un-reclaimed areas mined prior to the SMCRA continue to generate acid mine drainage in portions of the pyramid pigtoe's range. Direct impacts to the pyramid pigtoe from acid mine drainage in most occupied river reaches are unlikely because coal mining sites tend to be adjacent to smaller headwater streams, but mining pollutants can be

transferred downstream to pyramid pigtoe habitats.

Surface mining has been identified as a source of impairment for approximately 775 mi (1,247 km) of streams in Kentucky (Kentucky Department for Environmental Protection 2014, p. 66). Weathering of soils and rock broken apart to access coal seams typically increases alkalinity, total dissolved solids, salinity, and sedimentation and alters hydrology and physical habitat of streams receiving surface mine drainage, impacting fish and aquatic invertebrate communities (*e.g.,* Bernhardt and Palmer 2011, pp. 42–49; Linberg et al. 2011, entire; Hopkins and Roush 2013, pp. 585–586; Hitt and Chambers 2014, p. 923; Hitt et al. 2016, pp. 47–53). Mining continues to impair water quality in streams in the Cumberland Plateau and Central Appalachian regions of Tennessee and Kentucky (TDEC 2014, p. 62), which contain portions of the Tennessee and Cumberland River basins, and is the primary source of low pH impairment of 376 mi (605 km) of rivers in Tennessee (TDEC 2014, p. 53). Coal mining has resulted in discharges of industrial and mine wastes from coal mines and coal processing facilities in the Clinch and Powell Rivers (Ahlstedt et al. 2016, p. 8). Direct impacts to the pyramid pigtoe from acid mine drainage or total dissolved solids in most occupied river reaches are unlikely because coal mining sites tend to be adjacent to smaller headwater streams, but associated mining pollutants (fine sediments, metals, and salts) can be transferred downstream to medium and large river pyramid pigtoe habitats (Bernhardt and Palmer, 2011 p. 46).

Natural gas extraction in the Appalachians, including the Cumberland River basin, has negatively affected water quality through accidental spills and discharges, as well as increased sedimentation due to development of road construction, pipeline, drill pad construction, as well as tree removal required to clear the construction areas (Vidic et al. 2013, p. 6). Disposal of insufficiently treated brine wastewater, more saline than seawater, has specifically been found to adversely affect freshwater mussels (Patnode et al. 2015, p. 62). Potential threats from natural gas and oil exploration are also a concern in the White River basin.

Instream sand and alluvial gravel mining has been implicated in the destruction of mussel populations (Hartfield 1993, p. 138). Negative impacts associated with gravel mining include stream channel modifications such as altered habitat, disrupted flow patterns, and sediment transport (Hubbs et al. 2006, p. 170). Additionally, water quality modifications including increased turbidity, reduced light penetration, increased temperature, and increased sedimentation result from gravel mining. Commercial sand and gravel mining and dredging directly affects the pyramid pigtoe in the Tennessee River, specifically within the Lower Tennessee–Beech MU (Hubbs et al. 2006, p. 170). The Lower Cumberland Old Hickory MU has also been affected by gravel mining and dredging in the past (Sickel 1982, p. 4) that has resulted in permanent alteration of substrates and hydraulic patterns, contributing to habitat loss for freshwater mussels.

Invasive and Nonnative Species

Invasive and nonnative species in the range of the pyramid pigtoe include the Asian clam, zebra mussel, black carp, and the plant species, hydrilla. These nonnative species impact the pyramid pigtoe through competitive interactions, water quality degradation, predation, and habitat alteration.

The Asian clam, found throughout the range of the pyramid pigtoe, alters benthic substrates, may filter native mussel sperm or glochidia, competes with native species for limited resources, and causes ammonia spikes in surrounding water when dying off en masse (Scheller 1997, p. 2). A typical settlement of the Asian clam occurs with a population density ranging from 100 to 200 clams per square meter, which may not be detrimental to native unionids; however, populations can grow as large as 3,000 clams per square meter, which would influence both food resources and competition for space for the pyramid pigtoe.

Within the range of the pyramid pigtoe, the zebra mussel occurs in the Ohio, Tennessee, and Arkansas-White-Red River basins. Native mussels, such as the pyramid pigtoe, are negatively affected by zebra mussels through direct colonization, reduction of available habitat, changes in the biotic environment, or a reduction in food sources (MacIsaac 1996, p. 292). One of the direct consequences of the invasion of zebra mussels is the local extirpation of native freshwater mussel populations from (1) attachment to the shells of native mussels, which can kill them (zebra mussels are sessile, and cling to hard surfaces); (2) affecting vertical and lateral movements of native mussels, due to heavy infestations, which can prevent valve closure; and (3) outcompeting native mussels and other filter-feeding invertebrates for food. This problem has been particularly acute in the Ohio and Tennessee River systems. Densities of zebra mussels attained 17,000 per square meter in the Tennessee River below Wilson Dam in 2017, although recent survey efforts indicate a decline from that population explosion (Garner 2018, pers. comm.).

The black carp, which feeds on mollusks, is listed as ''injurious'' under the Lacey Act and occurs in the Ohio, Tennessee, Lower Mississippi and Arkansas-White-Red basins where it overlaps populations of the pyramid pigtoe. It is highly likely that this nonnative fish will negatively impact native aquatic communities by direct predation, thus reducing populations of native mussels (Nico et al. 2005, p. 193). Because black carp attain a large size and have a lifespan reportedly over 15 years, they have the potential to cause significant harm to native mollusks by predation on multiple age classes (Nico et al. 2005, p. 77).

In addition to negative impacts of nonnative animals, the invasive nonnative plant hydrilla can affect native mussels by covering spawning areas for native fish, which may be hosts for glochidia, and can cause significant reductions in stream oxygen levels (Colle et al. 1987, p. 410). Hydrilla is widespread in the Ohio, Cumberland, and Tennessee River systems. In general, invasive aquatic plants grow uncontrolled and can cause habitat to fill in, affect flow dynamics, and increase water temperature, exacerbating drought impacts in stream habitats (Colle et al. 1987, p. 416).

The Aquatic Nuisance Species (ANS) Task Force, co-chaired by the Service and the National Oceanic and Atmospheric Administration (NOAA), encourages State and interstate planning entities to develop management plans describing detection and monitoring efforts of aquatic nuisance and nonnative species, prevention efforts to stop their introduction and spread, and control efforts to reduce their impacts. Management plan approval by the ANS Task Force is required to obtain funding under Section 1204 of the ANS Prevention and Control Act. Each state within the range of the pyramid pigtoe has either a plan approved by or submitted to the ANS Task Force, or a plan under development. These plans have been effective in terms of raising awareness at the state level of the severity of ecological damage that non-native and nuisance species are capable of, but many are in early stages of implementation. Although laws and efforts are in place which may be effective in controlling or diminishing non-native and invasive species, these

organisms are a current and future threat to the pyramid pigtoe throughout its range.

Small Population Size

Historically, an extensive, largely contiguous pyramid pigtoe population occurred through much of the eastern half of the United States, and there were limited barriers preventing genetic interchange among river systems. With the completion of hundreds of dams in the 1900s, many large-river pyramid pigtoe populations were lost, resulting in isolation of tributary populations. The population size of a long-lived species, such as the pyramid pigtoe, may take decades to decline to extirpation post-impoundment. At best, limited post-impoundment recruitment may be occurring in the isolated pyramid pigtoe populations, indicating that these small populations are not likely viable long term.

Currently, the pyramid pigtoe exhibits several traits that reduce population viability, including small population size and low fecundity at many locations compared to other mussels. Smaller population size puts the species at greater risk of extirpation from stochastic events (*e.g.,* drought) or anthropomorphic changes and management activities that affect habitat. In addition, smaller populations may have reduced genetic diversity, be less genetically fit, and more susceptible to disease during extreme environmental conditions (Frankham 1996, p. 1,505). Moreover, small and isolated populations are at higher risk of further loss of genetic variation due to genetic drift, thereby lessening the affected species' ability to adapt to a continuously changing environment. Lastly, the relatively low fecundity, coupled with low juvenile survivorship, limit the pyramid pigtoe's ability to withstand and recover from population losses. While several populations of pyramid pigtoe are at risk of extirpation due to their small size, other populations are large enough and sufficiently connected within their MU that they are regularly recruiting new cohorts. Therefore, small population size is a population-level threat but not currently a species-level or rangewide threat.

Changing Climate Conditions

Climate change threats for freshwater mussels include alteration of natural stream flow and water temperature regimes as drought, precipitation, and temperature patterns shift. Population discontinuity and isolation is possible due to the dynamics in range shifts of mussels and their host fishes as a result of warming climates, based on life-history traits (Archambault et al. 2018, p. 880). However, the mechanisms behind these shifts and how they alter population connectivity and gene flow are uncertain, and there is no evidence linking climate change impacts specifically to the current status of the pyramid pigtoe.

Cumulative/Synergistic Effects

Collectively, threats to the pyramid pigtoe have acted on the species to reduce the number of historical populations and fragment and reduce the size of extant populations. Currently, 15 of the 35 extant populations are small in size, represented by fewer than 10 individuals observed over the past 20 years. Factors such as low effective population size, genetic isolation, relatively low levels of fecundity and recruitment, and limited juvenile survival could affect the ability of these species to maintain current population levels and to rebound if a reduction in population occurs (*e.g.,* through predation, toxic releases or spills, or poor environmental conditions that inhibit successful reproduction). Additionally, fragmentation (*i.e.,* the breaking apart of habitat segments, independent of habitat loss (Fahrig 2003; p. 299)) and isolation contribute to the extinction risk that mussel populations face from stochastic events (see Haag 2012, pp. 336–338). Throughout the range of the pyramid pigtoe, impoundments fragment and isolate populations from one another, prevent dispersal, which reduces gene flow (Vaughn 2012, p. 6; Service 2018, pp. 59–60; Service 2019, p. 74), and compound other threats, such as the introduction of contaminants and pollution resulting from mining, oil and gas exploration, agricultural runoff, and untreated or poorly treated wastewater discharges.

Current Conditions

Current (and future) conditions are described using the following categories that characterize the overall condition (resiliency) of the pyramid pigtoe populations:

- High—Population with more than 50 individuals reported since 2000, distributed over a more or less contiguous river or stream of at least 31 miles (mi) (50 kilometers (km)) in length, with evidence of recent recruitment. Water quality and habitat conditions remain optimal for recruitment, and multiple age classes are represented. Populations are not linearly distributed and occur in more than one stream within the river system.
- Medium—small restricted populations (10 to 50 individuals reported since 2000) generally distributed over a more or less contiguous length of river or stream of at least 6.2 mi (10 km) but less than 31 mi (50 km)), with some level of age class structure, but vulnerable to existing threats. Appropriate substrates are generally maintained with instream flows that mimic natural conditions. Water quality and habitat degradation may occur but not at a level that negatively affects both the density and extent of a population.
- Low—very small and highly restricted populations (fewer than 10 individuals reported since 2000), distributed over less than 6.2 mi (10 km) of river or stream, with little to no evidence of age class structure (only older individuals observable). Loss of mussel habitat or water quality degradation within the formerly occupied river or stream reach has been measured or observed, and imminent threats are documented. Population is linearly distributed and geographically restricted and is not likely to withstand stochastic events.

We assessed resiliency and redundancy based on management units (MUs) defined at the hydrologic unit code (HUC) scale (Seaber et al. 1987, entire; U.S. Geological Survey 2018, entire). Management units consisted of HUC–8 regions, which are analogous to medium-sized river basins across the United States. An MU consisting of a linear reach of stream could harbor one population or, if it contained a large gap in the species' distribution as a result of an impoundment or physiographic boundary, more than one population. If multiple tributaries were occupied (dendritic distribution) each tributary within the MU was considered to represent a population. A majority of MUs contained one population, given that the pyramid pigtoe occurs only in large or medium-sized rivers and not smaller tributaries.

Representation was assessed at the larger HUC–2 region (major basin) scale, and representation units were delineated to capture the variation in adaptive traits and genetic diversity. See chapter 2 in the SSA report for further explanation of the analysis methodology (Service 2021, pp. 20–22). Each major basin contains unique physiographic provinces and ecoregions. Therefore, the populations within each major basin may harbor basin-specific adaptive traits and as such species representation has been reduced from six basins to four basins. Historical connectivity between the major basins has been lost due habitat degradation and construction of

impoundments and there is no opportunity for exchange of beneficial, or adaptive, genes between the basins.

The pyramid pigtoe's current range extends over nine States, including Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Ohio, Oklahoma, Tennessee, and Virginia. The species is considered extirpated in Indiana, Illinois, Iowa, Kansas, Minnesota, Missouri, Pennsylvania, West Virginia, and Wisconsin. Its current range is within four major HUC–2 regions (the Arkansas-White-Red, Lower Mississippi, Ohio, and Tennessee River regions, Figure 1). It is extirpated in the Missouri and Upper Mississippi River HUC–2 regions. Overall, the pyramid pigtoe formerly occupied at least 135 MUs but currently occurs in 28 MUs (Figure 2). Known populations have declined in number, from 151 historically to 35 today. Currently, 15 MUs have low resiliency, 9 MUs have medium resiliency, and 4 MUs have high resiliency (Table 2, in *Future Conditions*).

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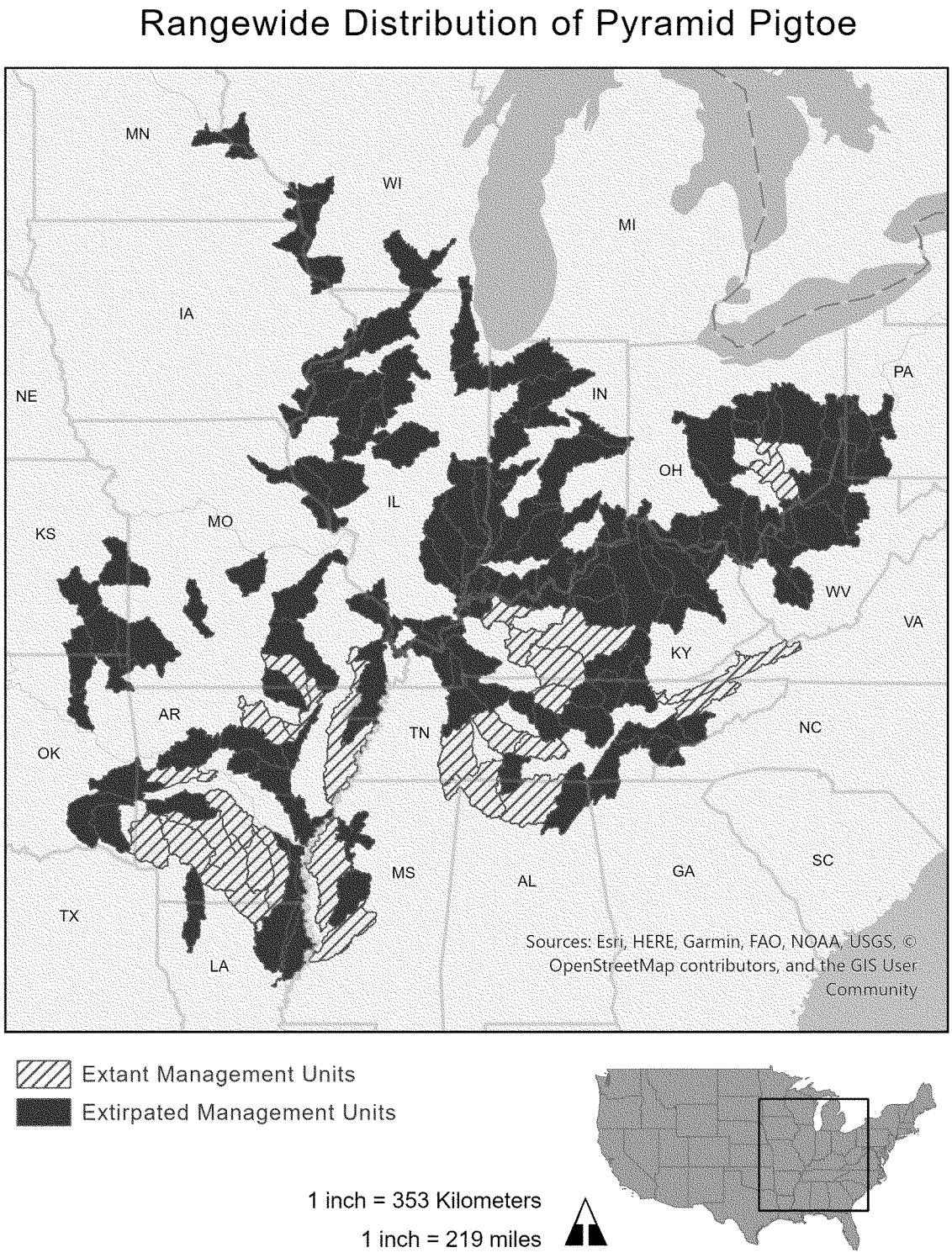

Figure 2. Extant and extirpated MUs (HUC–8) of pyramid pigtoe across its entire historical and current range.

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Future Conditions

In the SSA report, we forecast the pyramid pigtoe's response to plausible future scenarios of environmental conditions. The future scenarios project the range in magnitude and scope of threats into the future. Uncertainty is inherent in any risk assessment, so we must consider plausible conditions to make our determinations. When assessing the future, viability is not a specific state, but rather a continuous measure of the likelihood that the species will sustain populations over time.

The scenarios described in the SSA report represent two possible future conditions. Under scenario 1, the threat

levels remain unchanged (threats continue to act on the species at the current rate), whereas under scenario 2 the threat levels increase. Both scenarios project existing regulatory mechanisms and voluntary conservation measures benefiting the species remaining in place. We did not analyze a scenario whereby threat levels lessen because the primary threats that have fragmented and isolated populations will persist. Developed areas, large dams, and most of the small and retired dams affecting the species will remain in place.

We included climate change in our future scenarios as a factor that would add to the negative impacts of the primary threats on the species' habitat. Climate change is expected to alter the natural flow regime through increased drought and flooding worsening desiccation, scour, and sedimentation in each MU. However, in our analysis the influence of climate change, as a secondary threat, does not alter the projected future viability of any population or management unit. Those future outcomes are driven by the primary threats of habitat alteration or loss, nonnative invasive species, and the effects of small population size.

Using the scenarios, we project the pyramid pigtoe's viability over 20 to 30 years. We selected this duration because the species is slow growing and long-lived and has relatively low fecundity; long-term trend information on pyramid pigtoe abundance and threats is not available across the species' range to contribute to meaningful alternative timeframes.

Future resiliency of pyramid pigtoe populations depends on the extent to which the species' needs are met for water quality, flow, substrate suitability, abundance and distribution of host fish species, and habitat connectivity. We projected the expected future resiliency of each population based on how events likely to occur under each scenario would affect the species' resource needs. Future resiliency of each population is classified as high, medium, low, or very low. Where multiple populations occur within an MU, the MU condition is the average of the population condition classifications; however, there are no management units where the population classifications vary (*i.e.,* all populations within the MU have the same classification). These projections are informed by development planning documents, peer-reviewed literature, vetting of initial condition ranking by mussel experts, and our best professional judgment. Very low condition populations will become extirpated; low condition populations will become functionally extirpated (no recruitment); medium condition populations will exhibit limited recruitment and be linearly distributed and thus will have impaired ability to recover from disturbances and will be vulnerable to catastrophic events; and high condition populations will consistently recruit and be distributed over long distances and in connected mainstem and tributary river reaches (see SSA report for detailed future condition category definitions, Service 2021, pp. 84–85).

Our analysis shows that whether threats remain constant or increase into the future, all 35 populations are expected to experience negative changes to their important habitat requisites or resource needs, and the condition of many of the populations would decrease (Table 2). Under scenario 1, we expect 23 populations will be in low or very low condition and 9 in medium condition, with no to little resiliency, respectively. The remaining 3 populations occurring within the Saline or Upper Ouachita Rivers, where the impact of impoundments is not as severe as elsewhere in the species' range, are expected to maintain a high condition. Under scenario 2, we expect 31 populations to be either functionally extirpated (low condition) or extirpated (very low condition) and 4 to be in medium condition. With increasing threat levels, the population condition of the Saline and Upper Ouachita Rivers decline, and, thus, within 20 to 30 years no high condition populations remain.

TABLE 2—SUMMARY OF PYRAMID PIGTOE CURRENT MUSSEL POPULATION SIZE, EXTENT, THREAT LEVEL, AND PROJECTED FUTURE CONDITIONS. ONLY OVERALL CONDITION IS LISTED FOR FUTURE SCENARIOS

Management unit	Contiguous population (occupied river)	Population size	Population extent	Threat level	Current condition	Future condition	
						Scenario 1	Scenario 2
OHIO BASIN							
Muskingum	Muskingum River	Small	Small	High	Low	Very Low	Very Low.
Upper Green	Upper Green River	Large	Large	Low	High	Medium	Medium.
Barren	Barren River	Small	Small	Mod	Med	Medium	Low.
Middle Green	Middle Green River	Medium	Medium	Mod	Med	Medium	Low.
Lower Green	Lower Green River	Small	Small	Mod	Low	Low	Very Low.
Lower Cumberland-Old Hickory Lake.	Cumberland River (Old Hickory Reservoir) Cordell Hull Tailwater.	Medium	Small	High	Low	Very Low	Very Low.
TENNESSEE BASIN							
Holston	Holston River	Small	Small	High	Low	Very Low	Very Low.
Upper Clinch	Clinch River	Medium	Medium	Mod	Med	Low	Low.
Wheeler Lake	Paint Rock River	Small	Small	Mod	Low	Low	Very Low.
	Tennessee River (Wheeler Reservoir) Guntersville Tailwater.	Medium	Small	High	Low	Low	Very Low.
Pickwick Lake	Tennessee River (Pickwick Reservoir) Wilson Tailwater.	Medium	Medium	High	Low	Low	Low.
Lower Tennessee-Beech	Tennessee River (Kentucky Reservoir) Pickwick Tailwater.	Small	Small	High	Low	Low	Low.
Upper Duck	Upper Duck River	Large	Medium	Mod	Med	Medium	Low.
Lower Duck	Lower Duck River	Large	Small	Mod	Med	Low	Very Low.
ARKANSAS–WHITE–RED BASIN							
Petit Jean	Petit Jean River	Small	Small	Mod	Low	Low	Very Low.
Eleven Point	Eleven Point River	Small	Small	Low	Low	Low	Very Low.

TABLE 2—SUMMARY OF PYRAMID PIGTOE CURRENT MUSSEL POPULATION SIZE, EXTENT, THREAT LEVEL, AND PROJECTED FUTURE CONDITIONS. ONLY OVERALL CONDITION IS LISTED FOR FUTURE SCENARIOS—Continued

Management unit	Contiguous population (occupied river)	Population size	Population extent	Threat level	Current condition	Future condition	
						Scenario 1	Scenario 2
Lower Little	Little River	Medium	Small	Mod	Low	Low	Very Low.
LOWER MISSISSIPPI BASIN							
Lower Black	Lower Black River	Small	Small	Mod	Low	Low	Very Low.
Lower St. Francis	St. Francis River	Medium	Small	High	Med	Medium	Low.
	Tyronza River	Medium	Large	High	Med	Medium	Low.
Middle White	Middle White River	Small	Small	Mod	Low	Low	Very Low.
Upper Ouachita	Upper Ouachita River	Large	Large	Mod	High	High	Medium.
Little Missouri	Little Missouri River	Large	Medium	Mod	Med	Medium	Low.
Lower Ouachita-Smackover	Lower Ouachita River (Smackover).	Medium	Medium	Mod	Med	Medium	Low.
Upper Saline	Upper Saline River	Large	Large	Mod	High	High	Medium.
Lower Saline	Lower Saline River	Large	Large	High	High	High	Medium.
Bayou Bartholomew	Bayou Bartholomew	Large	Large	High	Med	Medium	Low.
Lower Ouachita-Bayou De Loutre.	Lower Ouachita River (Bayou De Loutre).	Medium	Medium	High	Low	Low	Low.
Big Sunflower	Hushpuckna River	Small	Small	High	Med	Low	Very Low.
	Bogue Phalia	Small	Small	High	Med	Low	Very Low.
	Little Sunflower River	Small	Small	High	Med	Low	Very Low.
	Sunflower River	Medium	Large	High	Med	Low	Very Low.
	Sandy Bayou	Small	Small	High	Med	Low	Very Low.
	Big Sunflower River	Medium	Large	High	Med	Low	Very Low.
Lower Big Black	Big Black River	Small	Small	High	Low	Very Low	Very Low.

The viability implications associated with the expected change in population conditions can be discerned at the MU and HUC–2 scales. Under scenario 1, we expect 3 MUs (11 percent) remain in high condition; 9 MUs (32 percent), in medium condition; 12 MUs (43 percent), in low condition; and 4 (14 percent), in very low condition. Therefore, the species' ability to withstand natural environmental variation and threats will be greatly limited. Loss of the three MUs reduces the species' distribution, increasing its risk to catastrophic events. The pyramid pigtoe will continue to be represented in the Ohio, Tennessee, and Lower Mississippi basins, but reduced to six States (as compared to the current nine States) occupied by the species. Representation will be lost from the Arkansas-White-Red basin, as all of its MUs are expected to be in low condition. It will take many years (potentially beyond the 20- to 30-year timeframe analyzed), for full evaluation of the species' response to any current beneficial actions, such as removal of Lock and Dam 6 on the Green River, or the safe harbor agreements and candidate conservation agreements with assurances in the Upper Ouachita and Upper Saline Rivers.

Under scenario 2, none of the MUs are expected to be in high condition, 4 (14 percent) are in medium condition, 11 (39 percent) are in low condition, and 13 (46 percent) are in very low condition. Given no MUs will be in high condition, the species' ability to withstand natural environmental variation and threats will be substantially limited. Redundancy will also be substantially reduced with no high condition MUs remaining and the expected loss of 13 (46 percent) MUs. Loss of the species from the Arkansas-White-Red basin, with no high condition MUs in any basin, and potential extirpation of the species from the States of Virginia, Ohio, Oklahoma, and Mississippi will substantially reduce the species' genetic diversity, thereby decreasing its ability to adapt to changing environmental conditions.

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. To assess the current and future condition of the species, we undertake an iterative analysis that encompasses and incorporates the threats individually and then accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Conservation Efforts and Regulatory Mechanisms

As discussed under *Threats,* Federal and State lands and water quality regulations afford the pyramid pigtoe and its habitats some protection from land development, industrial, and transportation activities. Additionally, laws intended to reduce the threat of nonnative species are in place. Many populations of the pyramid pigtoe were extirpated or reduced prior to development of modern conservation programs and regulatory mechanisms. As such, historical threats no longer present on the landscape impart a legacy effect (small population size or degraded habitat) on some current populations. Further, some water quality regulations have not been fully adopted or consistently applied across the species' range. Therefore, despite the existing regulatory mechanisms in place, the combined threats and impacts of actions that occurred prior to the implementation of these regulatory mechanisms continue to negatively affect the pyramid pigtoe.

Determination of Pyramid Pigtoe Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines an endangered species as a species ''in

danger of extinction throughout all or a significant portion of its range'' and a threatened species as a species ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether a species meets the definition of an endangered species or a threatened species because of any of the following 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.

Status Throughout All of Its Range

Historically, the pyramid pigtoe occurred within 151 populations and 136 MUs, in 6 basins across 18 States (Figure 2). Currently, the species occurs within 35 populations and 28 MUs, in 4 basins across 9 States, which represents a 77 percent reduction of its historically occupied populations. Of the extant MUs, 4 are highly resilient, while 9 and 15 have medium and low resiliency, respectively. The threats leading to its current condition include past and ongoing habitat degradation or loss (Factor A), residual impacts from past harvest and overutilization (Factor B), and ongoing competition, predation, and habitat alteration from invasive, nonnative species (Factor E). Collectively, these threats reduce population abundance, thereby precipitating negative genetic and demographic effects associated with small population size (Factor E) within some of the smaller populations. Although downtrends from historical numbers are evident and declines are likely to continue, four high resilient MUs are distributed across two of the four occupied major river basins. These four MUs provide for current representation and redundancy of the species. Thus, after assessing the best available information, we conclude that the pyramid pigtoe is not in danger of extinction throughout all of its range. We, therefore, proceed with determining whether the pyramid pigtoe is likely to become endangered within the foreseeable future throughout all of its range.

The best available information suggests that the threats currently acting upon the pyramid pigtoe will continue into the foreseeable future. In areas experiencing human population and land development growth, these threats (*e.g.,* water quality and habitat degradation) are reasonably expected to increase over time, further reducing the species' resiliency, redundancy, and representation. Our foreseeable future (20 to 30 years) reflects the period of time over which we can reliably predict both the threats to the pyramid pigtoe and the pyramid pigtoe's response to those threats based on the best available information. Within the foreseeable future, even if threats were to remain at current levels and not increase, 23 of the 35 populations are projected to become extirpated or functionally extirpated (Table 2). Additionally, with no change in threat levels, the condition of one of the four high resilient populations will decline to medium resiliency and the remaining three high resilient populations would be confined to a single basin. At the MU scale, only 3 of the 28 extant MUs remain in high condition, with 17 MUs projected to become extirpated or functionally extirpated within 20 to 30 years. If threats increase, 19 populations will likely be extirpated within 20 to 30 years, leading to only 4 MUs persisting. These MUs will have limited recruitment potential and restricted distribution, thus impairing the species' ability to recover from disturbances and increasing its vulnerability to catastrophic events. In summary, threats currently acting on the species are likely to persist or increase in the foreseeable future, resulting in zero to three high resilient populations in one of its six historical major basins and resulting in a high risk of impacts from a single catastrophe or stochastic events. Thus, after assessing the best available information, we conclude that the pyramid pigtoe is likely to become in danger of extinction within the foreseeable future throughout all of its range.

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. The court in *Center for Biological Diversity* v. *Everson,* 2020 WL 437289 (D.D.C. Jan. 28, 2020) (*Center for Biological Diversity*), vacated the aspect of the Final Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of ''Endangered Species'' and ''Threatened Species'' (79 FR 37578; July 1, 2014) that provided that the Service does not undertake an analysis of significant portions of a species' range if the species warrants listing as threatened throughout all of its range. Therefore, we proceed to evaluating whether the species is endangered in a significant portion of its range—that is, whether there is any portion of the species' range for which both (1) the portion is significant and (2) the species is in danger of extinction in that portion. Depending on the case, it might be more efficient for us to address the ''significance'' question or the ''status'' question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

Following the court's holding in *Center for Biological Diversity,* we now consider whether there are any significant portions of the species' range where the species is in danger of extinction now (*i.e.,* endangered). In undertaking this analysis for the pyramid pigtoe, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered.

For the pyramid pigtoe, we considered whether the threats are geographically concentrated in any portion of the species' range at a biologically meaningful scale. We examined the following threats: Habitat degradation or loss, invasive and nonnative species, and negative effects associated with small population size, including cumulative effects. Habitat degradation or loss, including diminished water quality, is a threat in all four basins occupied by the pyramid pigtoe, although the contribution by source (*e.g.,* agriculture, urbanization, mining, dredging) varies. Invasive or nonnative species also is a threat in each occupied basin. Lastly, large populations (number of individuals) occur in three of the four basins, and medium populations occur in all four basins.

We examined the Arkansas-White-Red basin (the only basin not containing any large populations) to determine if there is a concentration of threats because, of the three populations in the basin, two have a moderate threat level and one has a low threat level. All three of these populations are in a low current condition, and two of the three populations have small numbers of individuals. Thus, the cumulative effects of small population size with the other identified threats may be concentrated in this basin.

We then evaluated whether the Arkansas-White-Red basin may be biologically important to the overall species' viability, *i.e.,* significant. This basin contains 3 of the 35 (8.6 percent) pyramid pigtoe populations. By length of river, the populations combined occupy about 5 percent of the species' range. Therefore, the populations in the Arkansas-White-Red basin minimally contribute to the overall viability of the species.

The pyramid pigtoe occurs in similar habitats across the four basins it occupies and does not use unique observable environmental characteristics attributable to any of the basins. The Arkansas-White-Red basin populations occur in stream habitat with substrate types and water quality similar to the other basins where the pyramid pigtoe performs the important life-history functions of breeding, feeding, and sheltering. The basin does not act as a refugium for the species or as an important spawning ground. In addition, the water quality is similar throughout the species' range, with impaired water quality occurring in all four basins. Because the pyramid pigtoe occurs in similar aquatic habitats, the Arkansas-White-Red basin population exhibits similar habitat use as populations in the remainder of the range.

Overall, we found no substantial information that would indicate the Arkansas-White-Red basin is a portion of the range that may be significant in terms of its overall contribution to the species' resiliency, redundancy, and representation, or that it is significant in terms of high-quality habitat or habitat that is otherwise important for the species' life history. Additionally, within each of the other three basins (or portions of the range) there was no concentration of threats that would indicate the species is facing elevated threats in those portions. As a result, we determined there is no portion of the pyramid pigtoe's range that constitutes a significant portion of the range where the species is currently endangered. Accordingly, we determine that the species is likely to become in danger of extinction within the foreseeable future throughout all of its range. This is consistent with the courts' holdings in *Desert Survivors* v. *Department of the Interior,* No. 16–cv–01165–JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity* v. *Jewell,* 248 F. Supp. 3d, 946, 959 (D. Ariz. 2017).

Determination of Status

Our review of the best available scientific and commercial information indicates that the pyramid pigtoe meets the definition of a threatened species. Therefore, we propose to list the pyramid pigtoe as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

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 other countries and calls for recovery actions to be carried out for 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. Section 4(f) of the Act calls for 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 consists of preparing draft and final recovery plans, beginning with the development of a recovery outline and making it available to the public following a final listing determination. 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 also identifies recovery criteria for review of when a species may be ready for reclassification from endangered to threatened (''downlisting'') or removal from protected status (''delisting''), 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 (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our website (*http://www.fws.gov/endangered*), or from our Asheville Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, 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.

If this species is listed, 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, pursuant to section 6 of the Act, the States of Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Ohio, Oklahoma, Tennessee, and Virginia would be eligible for Federal funds to implement management actions that promote the protection or recovery of the pyramid pigtoe. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

Although the pyramid pigtoe is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. 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 an endangered or threatened species 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 consultation with the Service.

Federal agency actions within the species' habitat that may require conference, consultation, or both as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the following:

(1) U.S. Army Corps of Engineers (channel dredging and maintenance; dam projects including flood control, navigation, hydropower, bridge projects, stream restoration, and Clean Water Act permitting).

(2) U.S. Department of Agriculture, including the Natural Resources Conservation Service and Farm Service Agency (technical and financial assistance for projects) and the Forest Service (aquatic habitat restoration, fire management plans, fire suppression, fuel reduction treatments, forest plans, mining permits).

(3) U.S. Department of Energy (renewable and alternative energy projects).

(4) Federal Energy Regulatory Commission (interstate pipeline construction and maintenance, dam relicensing, and hydrokinetics).

(5) U.S. Department of Transportation (highway and bridge construction and maintenance).

(6) U.S. Fish and Wildlife Service (issuance of section 10 permits for enhancement of survival, habitat conservation plans, and safe harbor agreements; National Wildlife Refuge planning and refuge activities; Partners for Fish and Wildlife program projects benefiting these species or other listed species; Wildlife and Sportfish Restoration program sportfish stocking).

(7) Environmental Protection Agency (water quality criteria, permitting).

(8) Tennessee Valley Authority (flood control, navigation, hydropower, and land management for the Tennessee River system).

(9) Office of Surface Mining Reclamation and Enforcement (land resource management plans, mining permits, oil and natural gas permits, abandoned mine land projects, and renewable energy development).

(10) National Park Service (aquatic habitat restoration, fire management plans, fire suppression, fuel reduction treatments, land management plans, mining permits).

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 proposed listing on proposed and ongoing activities within the range of the species proposed for listing. The discussion below regarding protective regulations under section 4(d) of the Act complies with our policy.

II. Proposed Rule Issued Under Section 4(d) of the Act

Background

Section 4(d) of the Act contains two sentences. The first sentence states that the Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation of species listed as threatened. The U.S. Supreme Court has noted that statutory language like ''necessary and advisable'' demonstrates a large degree of deference to the agency (see *Webster* v. *Doe,* 486 U.S. 592 (1988)). Conservation is defined in the Act to mean the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Additionally, the second sentence of section 4(d) of the Act states that the Secretary may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1), in the case of fish or wildlife, or section 9(a)(2), in the case of plants. Thus, the combination of the two sentences of section 4(d) provides the Secretary with wide latitude of discretion to select and promulgate appropriate regulations tailored to the specific conservation needs of the threatened species. The second sentence grants particularly broad discretion to the Service when adopting the prohibitions under section 9.

The courts have recognized the extent of the Secretary's discretion under this standard to develop rules that are appropriate for the conservation of a species. For example, courts have upheld rules developed under section 4(d) as a valid exercise of agency authority where they prohibited take of threatened wildlife, or include a limited taking prohibition (see *Alsea Valley Alliance* v. *Lautenbacher,* 2007 U.S. Dist. Lexis 60203 (D. Or. 2007); *Washington Environmental Council* v. *National Marine Fisheries Service,* 2002 U.S. Dist. Lexis 5432 (W.D. Wash. 2002)). Courts have also upheld 4(d) rules that do not address all of the threats a species faces (see *State of Louisiana* v. *Verity,* 853 F.2d 322 (5th Cir. 1988)). As noted in the legislative history when the Act was initially enacted, ''once an animal is on the threatened list, the Secretary has an almost infinite number of options available to him with regard to the permitted activities for those species. He may, for example, permit taking, but not importation of such species, or he may choose to forbid both taking and importation but allow the transportation of such species'' (H.R. Rep. No. 412, 93rd Cong., 1st Sess. 1973).

Exercising this authority under section 4(d), we have developed a proposed rule that is designed to address the pyramid pigtoe's conservation needs. Although the statute does not require us to make a ''necessary and advisable'' finding with respect to the adoption of specific prohibitions under section 9, we find that this rule as a whole satisfies the requirement in section 4(d) of the Act to issue regulations deemed necessary and advisable to provide for the conservation of the pyramid pigtoe.

As discussed above under Summary of Biological Status and Threats, we have concluded that the pyramid pigtoe is likely to become in danger of extinction within the foreseeable future primarily due to declines in water quality, alteration and deterioration of instream habitats, fragmentation and isolation of populations, and nonnative species. These threats, which are expected to be exacerbated by continued urbanization and land development, were central to our assessment of the future viability of the pyramid pigtoe. The provisions of this proposed 4(d) rule would promote conservation of the pyramid pigtoe by encouraging management of the landscape in ways that meet the conservation needs of the pyramid pigtoe and are consistent with land management considerations. The provisions of this proposed rule are one of many tools that we would use to promote the conservation of the pyramid pigtoe. This proposed 4(d) rule would apply only if and when we make final the listing of the pyramid pigtoe as a threatened species.

Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they fund,

authorize, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. In addition, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of proposed critical habitat.

If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency (action agency) must enter into consultation with us. Examples of actions that are subject to the section 7 consultation process are actions on State, Tribal, local, or private lands that require a Federal permit or that involve some other Federal action such as funding, like those listed above under Available Conservation Measures. Federal actions not affecting listed species or critical habitat—and actions on State, Tribal, local, or private lands that are not federally funded, authorized, or carried out by a Federal agency—do not require section 7 consultation.

This obligation does not change in any way for a threatened species with a species-specific 4(d) rule. Actions that a Federal agency determines ''may affect'' listed species or critical habitat continue to require consultation and actions that are ''likely to adversely affect'' a species require formal consultation and the formulation of a biological opinion.

Provisions of the Proposed 4(d) Rule

This proposed 4(d) rule would provide for the conservation of the pyramid pigtoe by prohibiting the following activities, except as otherwise authorized or permitted: Importing or exporting; take; possession and other acts with unlawfully taken specimens; delivering, receiving, transporting, or shipping in interstate or foreign commerce in the course of commercial activity; or selling or offering for sale in interstate or foreign commerce.

As discussed above under Summary of Biological Status and Threats, multiple factors are affecting the status of the pyramid pigtoe. A range of activities have the potential to affect the pyramid pigtoe, including declines in water quality, alteration and deterioration of instream habitats, fragmentation and isolation of populations, and nonnative species. These threats, which are expected to continue due to land development for urbanization, agriculture, and resource extraction, channel navigation, and dam operations were central to our assessment of the future viability of the pyramid pigtoe. Therefore, we prohibit actions resulting in the incidental take of the pyramid pigtoe by altering or degrading its habitat.

Under the Act, ''take'' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Some of these provisions have been further defined in regulations at 50 CFR 17.3. Take can result knowingly or otherwise, by direct and indirect impacts, intentionally or incidentally. Regulating incidental and/or intentional take would help preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other stressors.

We may issue permits to carry out otherwise prohibited activities, including those described above, involving threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.32. With regard to threatened wildlife, a permit may be issued for the following purposes: For scientific purposes, to enhance propagation or survival, for economic hardship, for zoological exhibition, for educational purposes, for incidental taking, or for special purposes consistent with the purposes of the Act. The statute also contains certain exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

The proposed 4(d) rule would also provide for the conservation of the species by allowing exceptions for take associated with actions and activities that, while they may have some minimal level of disturbance to pyramid pigtoe, are not expected to negatively impact conservation and recovery efforts for the species. The proposed exceptions to these prohibitions include incidental take associated with (1) conservation efforts by the Service or State wildlife agencies, (2) channel restoration projects, (3) bank restoration projects, and (4) take necessary to aid a sick or injured specimen, or to salvage a dead specimen.

The first exception is for conservation and restoration efforts for pyramid pigtoe by the Service or State wildlife agencies, and including, but not limited to, collection of broodstock, tissue collection for genetic analysis, captive propagation, and subsequent stocking into unoccupied areas within the historical range of the species. We recognize the special and unique relationship with our State natural resource agency partners in contributing to conservation of listed species. State agencies often possess scientific data and valuable expertise on the status and distribution of endangered, threatened, and candidate species of wildlife and plants. State agencies, because of their authorities and their close working relationships with local governments and landowners, are in a unique position to assist the Service in implementing all aspects of the Act. In this regard, section 6 of the Act provides that the Service shall cooperate to the maximum extent practicable with the States in carrying out programs authorized by the Act. Therefore, any qualified employee or agent of a State conservation agency that is a party to a cooperative agreement with the Service in accordance with section 6(c) of the Act, who is designated by his or her agency for such purposes, would be able to conduct activities designed to conserve the pyramid pigtoe that may result in otherwise prohibited take without additional authorization.

The second and third exceptions are for channel and bank restoration projects for creation of natural, physically stable, ecologically functioning streams, taking into consideration connectivity with floodplain and groundwater aquifers. These exceptions include a requirement that bank restoration projects require planting appropriate native vegetation, including woody species appropriate for the region and habitat. We also propose language that would require surveys and relocation prior to commencement of restoration actions for pyramid pigtoe that would otherwise be negatively affected by the actions. We reiterate that these actions and activities may have some minimal level of take of pyramid pigtoe, but any such take is expected to be rare and insignificant and is not expected to negatively impact conservation and recovery efforts. Rather, we expect they would have a net beneficial effect on the species. Across the species' range, instream habitats have been degraded physically by sedimentation and by direct and indirect channel disturbance. The habitat restoration activities in the proposed 4(d) rule are intended to improve habitat conditions for the species in the long term.

Finally, the proposed 4(d) rule would allow take of pyramid pigtoe without a permit by any employee or agent of the Service or a State conservation agency designated by the agency for such purposes and when acting in the course of their official duties if such action is necessary to aid a sick or injured specimen, or to salvage a dead specimen which may be useful for scientific study. In addition, Federal and State wildlife law enforcement officers,

working in coordination with Service field office personnel, may possess, deliver, carry, transport, or ship pyramid pigtoe taken in violation of the Act as necessary.

Nothing in this proposed 4(d) rule would change in any way the recovery planning provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or the ability of the Service to enter into partnerships for the management and protection of the pyramid pigtoe. However, interagency cooperation may be further streamlined through planned programmatic consultations for the species between Federal agencies and the Service, where appropriate. We ask the public, particularly State agencies and other interested stakeholders that may be affected by the proposed 4(d) rule, to provide comments and suggestions regarding additional guidance and methods that the Service could provide or use, respectively, to streamline the implementation of this proposed 4(d) rule (see Information Requested, above).

III. Critical Habitat

Prudency Determination

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, the Secretary shall designate critical habitat at the time the species is determined to be an endangered or threatened species. Our regulations (50 CFR 424.12(a)(1)) state that the Secretary may, but is not required to, determine that a designation would not be prudent in the following circumstances:

(i) The species is threatened by taking or other human activity and identification of critical habitat can be expected to increase the degree of such threat to the species;

(ii) The present or threatened destruction, modification, or curtailment of a species' habitat or range is not a threat to the species, or threats to the species' habitat stem solely from causes that cannot be addressed through management actions resulting from consultations under section 7(a)(2) of the Act;

(iii) Areas within the jurisdiction of the United States provide no more than negligible conservation value, if any, for a species occurring primarily outside the jurisdiction of the United States;

(iv) No areas meet the definition of critical habitat; or

(v) The Secretary otherwise determines that designation of critical habitat would not be prudent based on the best scientific data available.

As discussed earlier in this document, there is currently no imminent threat of collection or vandalism identified under Factor B for this species, and identification and mapping of critical habitat is not expected to initiate any such threat. In our SSA and proposed listing determination for the pyramid pigtoe, we determined that the present or threatened destruction, modification, or curtailment of habitat or range is a threat to the pyramid pigtoe and that those threats in some way can be addressed by section 7(a)(2) consultation measures. The species occurs wholly in the jurisdiction of the United States, and we are able to identify areas that meet the definition of critical habitat. Therefore, because none of the circumstances enumerated in our regulations at 50 CFR 424.12(a)(1) have been met and because there are no other circumstances the Secretary has identified for which this designation of critical habitat would be not prudent, we have determined that the designation of critical habitat is prudent for the pyramid pigtoe.

Critical Habitat Determinability

Having determined that designation is prudent, under section 4(a)(3) of the Act we consider whether critical habitat for the pyramid pigtoe is determinable. Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist:

(i) Data sufficient to perform required analyses are lacking, or

(ii) The biological needs of the species are not sufficiently well known to identify any area that meets the definition of ''critical habitat.''

For the pyramid pigtoe, the species' needs are sufficiently well known. However, there is some uncertainty regarding the taxonomic identity of populations outside the Ohio, Cumberland, and Tennessee River basins (see **Background**), which is currently under investigation using different genetic markers than assessed thus far. Results of this taxonomic investigation, which may more accurately delineate the species' occupied range, are likely to be completed and submitted to a peer-reviewed journal within 1 year. In addition to this taxonomic investigation that may better determine critical habitat areas, a careful assessment of the economic impacts that may occur due to a critical habitat designation is ongoing, and we are in the process of acquiring the necessary information to perform that assessment. Because the information sufficient to perform a required analysis of the impacts of the designation is lacking, we find designation of critical habitat for the pyramid pigtoe to be not determinable at this time. The Act allows the Service an additional year to publish a critical habitat designation that is not determinable at the time of listing (16 U.S.C. 1533(b)(6)(C)(ii)).

Required Determinations

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 *et seq.*)

It is our position that, outside the jurisdiction of the U.S. Court of Appeals for the Tenth Circuit, we do not need to prepare environmental analyses pursuant to the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) in connection with regulations adopted pursuant to section 4(a) of the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). This position was upheld by the U.S. Court of Appeals for the Ninth Circuit *(Douglas County* v. *Babbitt,* 48 F.3d 1495 (9th Cir. 1995), cert. denied 516 U.S. 1042 (1996)).

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal

Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with Tribes in developing programs for healthy ecosystems, to acknowledge that Tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to Tribes. There are no Tribal lands within or adjacent to known pyramid pigtoe occupied habitat. We will coordinate with Tribes whose lands are close to pyramid pigtoe populations.

References Cited

A complete list of references cited in this rulemaking is available on the internet at *http://www.regulations.gov* and upon request from the Asheville Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the Fish and Wildlife Service's Species Assessment Team and the Asheville Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

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

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

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

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

■ 2. Amend § 17.11(h) by adding an entry for ''Pigtoe, pyramid'' to the List of Endangered and Threatened Wildlife in alphabetical order under Clams to read as set forth below:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
*	*	*	*	* * *
CLAMS				
*	*	*	*	* * *
Pigtoe, pyramid ..	*Pleurobema rubrum.*	Wherever found ..	T	[**Federal Register** citation when published as a final rule]; 50 CFR 17.45(e); [4d].
*	*	*	*	* * *

■ 3. As proposed to be added at 83 FR 51570 (Oct. 11, 2018), and amended at 85 FR 44821 (July 24, 2020), 85 FR 59487 (Sept. 22, 2020), 85 FR 61384 (Sept. 29, 2020), and 86 FR 47916 (August 26, 2021), § 17.45 is further amended by adding paragraph (e) to read as follows:

§ 17.45 Special rules—snails and clams.

* * * * *

(e) Pyramid pigtoe *(Pleurobema rubrum).*

(1) *Prohibitions.* The following prohibitions that apply to endangered wildlife also apply to the pyramid pigtoe. Except as provided under paragraph (e)(2) of this section and §§ 17.4 and 17.5, it is unlawful for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit, or cause to be committed, any of the following acts in regard to this species:

(i) Import or export, as set forth at § 17.21(b) for endangered wildlife.

(ii) Take, as set forth at § 17.21(c)(1) for endangered wildlife.

(iii) Possession and other acts with unlawfully taken specimens, as set forth at § 17.21(d)(1) for endangered wildlife.

(iv) Interstate or foreign commerce in the course of commercial activity, as set forth at § 17.21(e) for endangered wildlife.

(v) Sale or offer for sale, as set forth at § 17.21(f) for endangered wildlife.

(2) *Exceptions from prohibitions.* In regard to this species, you may:

(i) Conduct activities as authorized by a permit under § 17.32.

(ii) Take, as set forth at § 17.21(c)(3) and (4) for endangered wildlife.

(iii) Take as set forth at § 17.31(b).

(iv) Take incidental to an otherwise lawful activity caused by:

(A) Channel restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems). These projects can be accomplished using a variety of methods, but the desired outcome is a natural channel with low shear stress (force of water moving against the channel); bank heights that enable reconnection to the floodplain; connection of surface and groundwater systems, resulting in perennial flows in the channel; riffles and pools composed of existing soil, rock, and wood instead of large imported materials; low compaction of soils within adjacent riparian areas; and inclusion of riparian wetlands. Streams reconstructed in this way would offer suitable habitats for the pyramid pigtoe and contain stable channel features, such as pools, glides, runs, and riffles, which could be used by the species and its host fish for spawning, rearing, growth, feeding, migration, and other normal behaviors. Prior to commencement of restoration actions, surveys to determine presence of the pyramid pigtoe must be performed, and, if any pyramid pigtoe are located, in coordination with the local Service field office, they must be relocated prior to project implementation and monitored post-implementation. To qualify under this exemption, a channel restoration project must satisfy all Federal, State, and local permitting requirements.

(B) Bank restoration projects that use bioengineering methods to replace preexisting, bare, eroding stream banks with vegetated, stable stream banks, thereby reducing bank erosion and instream sedimentation and improving habitat conditions for the species. Following these bioengineering methods, stream banks may be stabilized using native species live stakes (live, vegetative cuttings inserted

or tamped into the ground in a manner that allows the stake to take root and grow), native species live fascines (live branch cuttings, usually willows, bound together into long, cigar-shaped bundles), or native species brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). Bank restoration projects would require planting appropriate native vegetation, including woody species appropriate for the region and habitat. These methods will not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion structures. Prior to commencement of bank stabilization actions, surveys to determine presence of pyramid pigtoe must be performed, and, if any pyramid pigtoe are located, in coordination with the local Service field office, they must be relocated prior to project implementation and monitored post-implementation. To qualify under this exemption, a bank restoration project must satisfy all Federal, State, and local permitting requirements.

(v) Possess and engage in other acts with unlawfully taken wildlife, as set forth at § 17.21(d)(2) for endangered wildlife.

Martha Williams,

Principal Deputy Director, Exercising the Delegated Authority of the Director, U.S. Fish and Wildlife Service.

[FR Doc. 2021–19091 Filed 9–3–21; 8:45 am]

BILLING CODE 4333–15–P