



## DEPARTMENT OF THE INTERIOR

### Fish and Wildlife Service

#### 50 CFR Part 17

[Docket No. FWS–R2–ES–2016–0077; 4500030113]

RIN 1018–BB34

### Endangered and Threatened Wildlife and Plants; Endangered Species Status for Texas Hornshell

**AGENCY:** Fish and Wildlife Service, Interior.

**ACTION:** Proposed rule.

**SUMMARY:** We, the U.S. Fish and Wildlife Service (Service), propose to list the Texas hornshell (*Popenaias popeii*), a freshwater mussel species from New Mexico and Texas, as an endangered species under the Endangered Species Act (Act). If we finalize this rulemaking as proposed, it would extend the Act's protections to this species.

**DATES:** We will accept comments received or postmarked on or before **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

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 public hearings, in writing, at the address shown in **FOR**

**FURTHER INFORMATION CONTACT** by **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

**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 FWS–R2–ES–2016–0077, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on “Comment Now!”

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R2–ES–2016–0077, U.S. Fish and Wildlife Service, MS: BPHC, 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 *Public Comments*, below, for more information).

**FOR FURTHER INFORMATION CONTACT:** Chuck Ardizzone, U.S. Fish and Wildlife Service, Texas Coastal Ecological Services Field Office, 17629 El Camino Real #211, Houston, TX 77058; by telephone 281–286–8282; or by facsimile 281–488–5882. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 800–877–8339.

#### **SUPPLEMENTARY INFORMATION:**

##### **Executive Summary**

*Why we need to publish a rule.* Under the Act, if a species is determined to be 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. Critical habitat shall be designated, to the maximum extent prudent and determinable, for any species determined to be an

endangered or threatened species under the Act. Listing a species as an endangered or threatened species and designations and revisions of critical habitat can only be completed by issuing a rule.

*This rulemaking* proposes the listing of the Texas hornshell (*Popenaias popeii*) as an endangered species. The Texas hornshell is a candidate species for which we have on file sufficient information on biological vulnerability and threats to support preparation of a listing proposal, but for which development of a listing regulation has been precluded by other higher priority listing activities. This proposed rule reassesses all available information regarding the status of and threats to the Texas hornshell.

*The basis for our action.* Under the Act, we can determine that a species is an endangered or threatened species based on any of five factors, acting alone or in combination: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that the Texas hornshell is in danger of extinction due to habitat loss from loss of water flow, decreased water quality, and increased accumulation of fine sediments (Factor A) and predation (Factor C).

*We will seek peer review.* We will seek comments from independent specialists to ensure that our determination is based on scientifically sound data, assumptions, and analyses. We will invite these peer reviewers to comment on our listing proposal. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal.

We prepared a species status assessment report (SSA report) for the Texas hornshell. The SSA report documents the results of the comprehensive biological status review for the Texas hornshell and provides an account of the species' overall viability through forecasting of the species' condition in the future (Service 2016, entire). We received feedback from four scientists with expertise in freshwater mussel biology, ecology, and genetics as peer review of the SSA report. The reviewers were generally supportive of our approach and made suggestions and comments that strengthened our analysis. The SSA report and other materials relating to this proposal can be found at <http://www.regulations.gov> under Docket No. FWS-R2-ES-2016-0077.

### **Information Requested**

#### *Public Comments*

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 concerned 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 Texas hornshell's biology, range, and population trends, including:
  - (a) Biological or ecological requirements of the species, including habitat requirements for feeding and spawning;
  - (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, particularly in Mexico.

(5) Information related to climate change within the range of the Texas hornshell and how it may affect the species' habitat.

(6) The reasons why areas should or should not be designated as critical habitat as provided by section 4 of the Act (16 U.S.C. 1531 et seq.)

(7) Specific information on:

(a) The amount and distribution of habitat for the Texas hornshell;

(b) What areas, that are currently occupied and that contain the physical and biological features essential to the conservation of the Texas hornshell, should be included in a critical habitat designation and why;

(c) Special management considerations or protection that may be needed for the essential features in potential critical habitat areas, including managing for the potential effects of climate change; and

(d) What areas not occupied at the time of listing 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 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>, or by appointment, during normal business hours, at the U.S.

Fish and Wildlife Service, Texas Coastal Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

#### *Public Hearing*

Section 4(b)(5) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register** (see **DATES**, above). Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing.

#### *Peer Review*

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of five appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our listing determination is based on scientifically sound data, assumptions, and analyses. We invite comment from the peer reviewers during the public comment period on this proposed rule.

#### **Previous Federal Actions**

We identified the Texas hornshell as a Category 2 candidate species in our January 6, 1989, Review of Vertebrate Wildlife (54 FR 554). Category 2 candidates were defined as species for which we had information that proposed listing was possibly appropriate, but conclusive data on biological vulnerability and threats were not available

to support a proposed rule at the time. The species remained a Category 2 candidate in subsequent annual candidate notices of review (CNOR) (56 FR 58804, November 21, 1991, and 59 FR 58982, November 15, 1994). In the February 28, 1996, CNOR (61 FR 7596), we discontinued the designation of Category 2 species as candidates; therefore, the Texas hornshell was no longer a candidate species.

Subsequently, in 2001, the Texas hornshell was added to the candidate list (66 FR 54808, October 30, 2001). Candidates are those fish, wildlife, and plants for which we have on file sufficient information on biological vulnerability and threats to support preparation of a listing proposal, but for which development of a listing rule is precluded by other higher priority listing activities. The Texas hornshell was included in all of our subsequent annual CNORs (67 FR 40657, June 13, 2002; 69 FR 24876, May 4, 2004; 70 FR 24870, May 11, 2005; 71 FR 53756, September 12, 2006; 72 FR 69034, December 6, 2007; 73 FR 75176, December 10, 2008; 74 FR 57804, November 9, 2009; 75 FR 69222, November 10, 2010; 76 FR 66370, October 26, 2011; 77 FR 69994, November 21, 2012; 78 FR 70104; November 22, 2013; 79 FR 72450, December 5, 2014; and 80 FR 80584, December 24, 2015). On May 11, 2004, we were petitioned to list the Texas hornshell, although no new information was provided in the petition. Because we had already found the species warranted listing, no further action was taken on the petition.

On September 9, 2011, the Service entered into two settlement agreements regarding species on the candidate list at that time (Endangered Species Act Section 4 Deadline Litigation, No. 10–377 (EGS), MDL Docket No. 2165 (D.D.C. May 10, 2011)). This proposed listing rule fulfills the requirements of those settlement agreements for the Texas hornshell.

## **Background**

A thorough review of the taxonomy, life history, ecology, and overall viability of the Texas hornshell (*Popenaias popeii*) is presented in the Species Status Assessment Report for the Texas Hornshell (SSA report) (Service 2016; available at <http://www.regulations.gov>). The SSA report documents the results of the comprehensive biological status review for the Texas hornshell and provides an account of the species' overall viability through forecasting of the species' condition in the future (Service 2016, entire). In the SSA report, we summarized the relevant biological data and a description of past, present, and likely future stressors and conducted an analysis of the viability of the species. The SSA report provides the scientific basis that informs our regulatory decision regarding whether this species should be listed as an endangered or threatened species under the Act. This decision involves the application of standards within the Act, its implementing regulations, and Service policies (see **Determination**, below). The SSA report contains the risk analysis on which this determination is based, and the following discussion is a summary of the results and conclusions from the SSA report. We solicited peer review of the draft SSA report from five qualified experts. We received responses from four of the reviewers, and we modified the SSA report as appropriate.

### *Species Description*

The Texas hornshell is a medium sized (3 to 4 inches long) freshwater mussel with a dark brown to green, elongate, laterally compressed shell (Howells *et al.* 1996, p. 93; Carman 2007, p. 2). The Texas hornshell was described by Lea (1857, p. 102) from the Devils River in Texas and Rio Salado in Mexico. Currently, the Texas hornshell is

classified in the unionid subfamily Ambleminae (Campbell *et al.* 2005, pp. 140, 144) and is considered a valid taxon by the scientific community (Turgeon *et al.* 1998, p. 36).

Freshwater mussels, including the Texas hornshell, have a complex life history. Males release sperm into the water column, which are taken in by the female through the incurrent siphon (the tubular structure used to draw water into the body of the mussel). The sperm fertilizes the eggs, which are held during maturation in an area of the gills called the marsupial chamber. The developing larvae remain in the gill chamber until they mature and are ready for release. These mature larvae, called glochidia, are obligate parasites (cannot live independently of their hosts) on the gills, head, or fins of fishes (Vaughn and Taylor 1999, p. 913). Glochidia die if they fail to find a host fish, attach to a fish that has developed immunity from prior infestations, or attach to the wrong location on a host fish (Neves 1991, p. 254; Bogan 1993, p. 599). Glochidia encyst (enclose in a cyst-like structure) on the host's tissue, draw nutrients from the fish, and develop into juvenile mussels weeks or months after attachment (Arey 1932, pp. 214–215).

For the Texas hornshell, spawning generally occurs from March through August (Smith *et al.* 2003, p. 335), and fertilized eggs are held in the marsupial chambers of females for 4 to 6 weeks (Smith *et al.* 2003, p. 337). Glochidia are released in a sticky mucous net or string (Carman 2007, p. 9); the host fish likely swim into the nets, and the glochidia generally attach to the face or gills of the fish and become encysted in its tissue (Levine *et al.* 2012, pp. 1858). The glochidia will remain encysted for about a month through transformation to the juvenile stage. Once transformed, the juveniles will excyst from the fish and drop to the substrate. The known primary host fishes for the Texas

hornshell are river carpsucker (*Carpiodes carpio*), grey redhorse (*Moxostoma congestum*), and red shiner (*Cyprinella lutrensis*) (Levine *et al.* 2012, pp. 1857–1858).

Mussels are generally immobile but experience their primary opportunity for dispersal and movement within the stream as glochidia attached to a mobile host fish (Smith 1985, p. 105). Upon release from the host, newly transformed juveniles drop to the substrate on the bottom of the stream. Those juveniles that drop in unsuitable substrates die because their immobility prevents them from relocating to more favorable habitat. Juvenile freshwater mussels burrow into interstitial substrates and grow to a larger size that is less susceptible to predation and displacement from high flow events (Yeager *et al.* 1994, p. 220). Throughout the rest of their life cycle, mussels generally remain within the same small area where they excysted from the host fish.

Life span is not known for the Texas hornshell, although two adult individuals were captured and marked in the Black River in New Mexico in 1997, and were recaptured 15 years later (Inoue *et al.* 2014, p. 5). Species in the subfamily Ambleminae, which includes Texas hornshell, commonly live more than 20 years (Carman 2007, p. 9), so we assume the Texas hornshell can live at least 20 years.

Little is known about the specific feeding habits of Texas hornshell. Like all adult freshwater mussels, Texas hornshell are filter feeders, siphoning suspended phytoplankton and detritus from the water column (Yeager *et al.* 1994, p. 221; Carman 2007, p. 8).

#### *Habitat and Range*

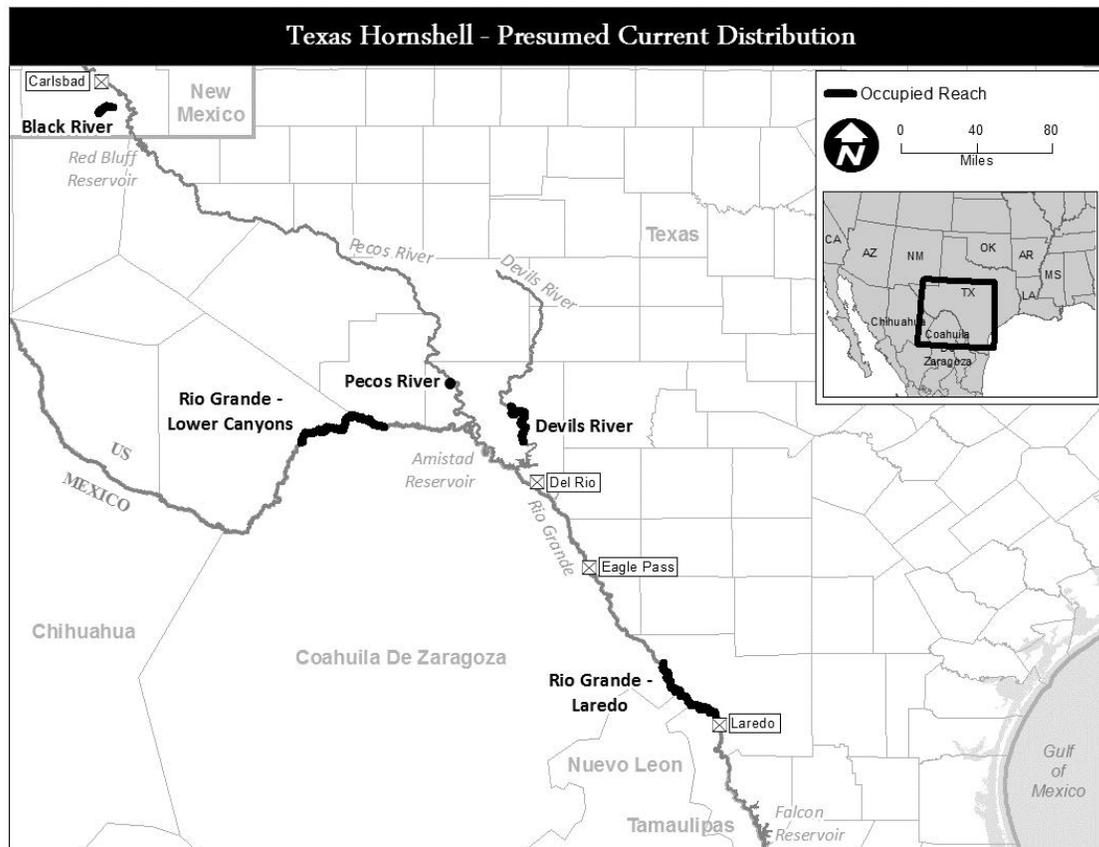
Adult Texas hornshell occur in medium to large rivers, in habitat not typical for most mussel species: in crevices, undercut riverbanks, travertine shelves, and under large

boulders adjacent to runs (Carman 2007, p. 6; Randklev *et al.* 2015, p. 8), although in the Devils River, the species is found in gravel beds at the heads of riffles and rapids (Randklev *et al.* 2015, p. 8). Small-grained material, such as clay, silt, or sand, gathers in these crevices and provides suitable anchoring substrate. These crevices are considered to be flow refuges from the large flood events that occur regularly in the rivers this species occupies. Texas hornshell are able to use these flow refuges to avoid being swept away as large volumes of water move through the system, as there is relatively little particle movement in the flow refuges, even during flooding (Strayer 1999, p. 472). Texas hornshell are not known from lakes, ponds, or reservoirs.

The Texas hornshell historically ranged throughout the Rio Grande drainage in the United States (New Mexico and Texas) and Mexico as well as Mexican Gulf Coast streams south to the northern Mexican state of Veracruz (Johnson 1999, p. 23).

Currently, five known populations of Texas hornshell remain in the United States: Black River (Eddy County, New Mexico), Pecos River (Val Verde County, Texas), Devils River (Val Verde County, Texas), Lower Canyons of the Rio Grande (Brewster and Terrell Counties, Texas), and Lower Rio Grande near Laredo (Webb County, Texas) (Map 1). They are described briefly below.

### **Map 1. Presumed Current Distribution of Texas Hornshell**



Black River: The Black River, in Eddy County, New Mexico, originates from several groundwater-fed springs and flows approximately 30 miles (mi) (48 kilometers (km)) through the Chihuahuan Desert until its confluence with the Pecos River (Inoue *et al.* 2014, p. 3) near Malaga, New Mexico. Extensive population monitoring (Lang 2001, entire; 2006, entire; 2010, entire; 2011, entire) and a long-term mark-recapture study (Inoue *et al.* 2014, entire) have yielded significant information about the population size and extent. Texas hornshell occur in approximately 8.7 mi (14.0 km) of the middle Black River, between two low-head (small) dams (Lang 2001, p. 20). The total population size has been estimated at approximately 48,000 individuals (95 percent confidence interval: 28,849–74,127) (Inoue *et al.* 2014, p. 7), with a diversity of size classes, primarily

aggregated in flow refuges within narrow riffles. The population remained relatively stable over the 15 year study period from 1997 to 2012 (Inoue *et al.* 2014, p. 6).

Pecos River: In the Pecos River, inundation from Amistad Reservoir has resulted in the extirpation of Texas hornshell from the lower reaches of the river. Additionally, salinity levels are too high for freshwater mussel habitation in much of the Pecos River from the confluence with the Black River in New Mexico, downstream to the confluence with Independence Creek. However, three live Texas hornshell were collected from a small section of the Pecos River downstream of the confluence with Independence Creek and upstream of Amistad Reservoir near Pandale in Val Verde County, Texas, as well as 37 shells (Bosman *et al.* 2016, p. 6; Randklev *et al.* 2016, p. 9). Farther downstream, only dead shells were found in 2016, although they were numerous (Bosman *et al.* 2016, p. 6; Randklev *et al.* 2016, p. 9). Live individuals had not been collected at this location since 1973 (Randklev *et al.* 2016, p. 4).

Because the sample size of live individuals is so small (three live individuals found in recent months), it is difficult to draw many conclusions about the population. The population appears to be extremely small, and no evidence of reproduction was noted.

Devils River: Texas hornshell were historically found in the Devils River and were known to occupy only the lower reaches of the river, which are currently inundated by Amistad Reservoir (Neck 1984, p. 11; Johnson 1999, p. 23; Burlakova and Karatayev 2014, p. 19). In recent years, 11 individuals were collected from upstream in the Devils River between 2008 and 2014 (Burlakova and Karatayev 2014, p. 16; Karatayev *et al.* 2015, p. 4). More intensive surveys conducted in 2014 and 2015, including 11 sites, have

yielded 48 individuals at two sites: all from The Nature Conservancy's Dolan Falls Preserve except for a singleton at the Devils River State Natural Area's Dan A. Hughes Unit (formerly known as the Big Satan Unit) (Randklev *et al.* 2015, pp. 6–7). Because of the increased number of individuals collected in 2014 and 2105, it is likely that the Devils River population is more numerous than previously thought, although we do not expect that this population is particularly large based on the limited number of collections to date. Interestingly, Texas hornshell in the Devils River occupy different habitats than those in the rest of the range; instead of being found under rock slabs and in travertine shelves, they occupy gravel beds at the heads of riffles or in clean-swept pools with bedrock (Randklev *et al.* 2015, p. 8). Even though the number of collected individuals is small, several young individuals were found, as well as females brooding glochidia (gravid females) (Randklev *et al.* 2015, p. 8), indicating reproduction and recruitment (offspring survive to join the reproducing population) are occurring in the Devils River population.

Rio Grande—Lower Canyons: One of two remaining populations of Texas hornshell in the Rio Grande is found in the Lower Canyons, just downstream of Big Bend National Park, in Terrell County, Texas. Burlakova and Karatayev (2014, p. 16) found the species in low density (approximately 40 individuals per km) in this region of the Rio Grande. Subsequent surveys by Randklev *et al.* (2015, entire) confirmed the presence of Texas hornshell in approximately 18.5 mi (30 km) of the Lower Canyons in two sections, finding that the species occupies approximately 63 percent of sites with suitable (rocky) habitat. For purposes of this analysis, we presume the entire section between these collections, approximately 62 mi (100 km), is occupied. Sites in the Rio Grande—Lower

Canyons reach vary in density, with the densest sites near Sanderson Canyon, Terrell County, Texas, and decreasing downstream (Randklev *et al.* 2015, p. 13); the average density of Texas hornshell at each site is lower compared to the Black River and Rio Grande—Laredo ( $5 \pm 14$  individuals per site). Texas hornshell may occur between the known occupied sections, near the confluence with San Francisco Creek (Howells 2001a, p. 6), but limited access has prevented recent surveys from determining current occupancy of this reach. Young individuals and gravid females have been found throughout the Lower Canyons reach, indicating recruitment is occurring (Randklev *et al.* 2015, p. 8).

Rio Grande—Laredo: The largest Texas hornshell population occurs from Laredo, Texas (near La Bota Ranch just northwest of Laredo), upstream approximately 56 mi (90 km) (Randklev *et al.* 2015, p. 7). The density in this reach is high, with some habitat patches containing more than 8,000 individuals (Karatayev *et al.* 2015, p. 4) and 100 percent of surveyed patches of suitable habitat containing Texas hornshell (Randklev *et al.* 2015, p. 7). Throughout this reach, the density of Texas hornshell is estimated  $170 \pm 131$  individuals per suitable (rocky) habitat site (Randklev *et al.* 2015, p. 7). Young individuals and gravid females have been found throughout the Laredo reach, indicating reproduction and recruitment are occurring (Randklev *et al.* 2015, p. 8). No live Texas hornshell have been found downstream of the city of Laredo in recent years.

Mexico: A large portion of the Texas hornshell's estimated historical range is in Mexico. The species occurred in the Rio Salado basin, which is a tributary to the Rio Grande in Mexico, and in approximately 15 rivers that flow into the Gulf of Mexico. At one time, one-half to two-thirds of the species' range may have been in Mexico.

Unfortunately, the most recent live collections of Texas hornshell in Mexico occurred in the 1980s (Mussel Project 2015, entire), and we have very few records of surveys with positive or negative collection data since that time. We have no information on population size or extent during those times of collection, and we also have no information on whether populations of Texas hornshell still occur in one or more of these streams; therefore, we have very low confidence in the species' current condition throughout most of the Mexican range. One or more of these populations may still be extant, or they may all be extirpated.

### *Species Needs*

Texas hornshell need seams of fine sediment in crevices, undercut riverbanks, travertine shelves, and large boulders in riverine ecosystems with flowing water and periodic cleansing flows to keep the substrate free of fine sediment accumulation. They need water quality parameters to be within a suitable range (*i.e.*, dissolved oxygen above 3 milligrams/liter (mg/L), salinity below 0.9 parts per thousand, and ammonia below 0.7 mg/L (Sparks and Strayer 1998, p. 132; Augspurger *et al.* 2003, p. 2574; Augspurger *et al.* 2007, p. 2025; Carman 2007, p. 6)) and phytoplankton as food. Finally, Texas hornshell need host fish to be present during times of spawning.

We describe the Texas hornshell's viability by characterizing the status of the species in terms of its resiliency (ability of the populations to withstand stochastic events), redundancy (ability of the species to withstand large-scale, catastrophic events), and representation (the ability of the species to adapt to changing environmental conditions). Using various time frames and the current and projected resiliency, redundancy, and representation, we describe the species' level of viability over time. For

the Texas hornshell to maintain viability, its populations or some portion thereof must be resilient. A number of factors influence the resiliency of Texas hornshell populations, including occupied stream length, abundance, and recruitment. Elements of Texas hornshell habitat that determine whether Texas hornshell populations can grow to maximize habitat occupancy influence those factors, thereby increasing the resiliency of populations. These resiliency factors and habitat elements are discussed here.

Occupied Stream Length: Most freshwater mussels, including Texas hornshell, are found in aggregations, called mussel beds, that vary in size from about 50 to greater than 5,000 square meters ( $m^2$ ) (540 to greater than 53,800 square feet ( $ft^2$ )), separated by stream reaches in which mussels are absent or rare (Vaughn 2012, p. 983). Resilient Texas hornshell populations must occupy stream reaches sufficient in length such that stochastic events that affect individual mussel beds do not eliminate the entire population. Repopulation by fish infested with Texas hornshell glochidia from other mussel beds within the reach, if present and connected, can allow the population to recover from these events.

Abundance: Mussel abundance in a given stream reach is a product of the number of mussel beds times the density of mussels within those beds. For populations of Texas hornshell to be resilient, there must be many mussel beds of sufficient density (~200 individuals per  $150 m^2$  ( $1,614 ft^2$ ); see SSA report for more discussion) such that local stochastic events do not necessarily eliminate the bed(s), allowing the mussel bed and the overall population in the stream reach to recover from any one event. We measure Texas hornshell abundance by the number of beds within the population, and the estimated density of Texas hornshell within each.

Reproduction: Resilient Texas hornshell populations must also be reproducing and recruiting young individuals into the reproducing population. Population size and abundance reflects previous influences on the population and habitat, while reproduction and recruitment reflect population trends that may be stable, increasing, or decreasing. Detection of very young juvenile mussels during routine abundance and distribution surveys happens extremely rarely due to sampling bias; sampling for this species involves tactile searches, and mussels below about 35 millimeters (mm) (1.4 inches (in)) are very hard to detect. Therefore, reproduction is verified by repeatedly capturing small-sized individuals near the low end of the detectable range size (about 35 mm (1.4 in)) over time and by capturing gravid females during the reproductively active time of year (generally, March through August (Smith *et al.* 2003, p. 335)).

Substrate: Texas hornshell occur in flow refuges such as crevices, undercut riverbanks, travertine shelves, and large boulders. These refuges must have seams of clay or other fine sediments within which the mussels may anchor, but not so much excess sediment that the mussels are smothered. Those areas with clean-swept substrate with seams of fine sediments are considered to have suitable substrate, and those with copious fine sediment both in crevices and on the stream bottom are considered less suitable.

Flowing Water: Texas hornshell need flowing water for survival. They are not found in lakes or in pools without flow, or in areas that are regularly dewatered. River reaches with continuous flow are considered suitable habitat, while those with little or no flow are considered not suitable.

Water Quality: Freshwater mussels, as a group, are sensitive to changes in water quality parameters such as dissolved oxygen, salinity, ammonia, and pollutants (*i.e.*,

dissolved oxygen above 3 mg/L, salinity below 0.9 parts per thousand, and ammonia below 0.7 mg/L (Sparks and Strayer 1998, p. 132; Augspurger *et al.* 2003, p. 2574; Augspurger *et al.* 2007, p. 2025; Carman 2007, p. 6)). Habitats with appropriate levels of these parameters are considered suitable, while those habitats with levels outside of the appropriate ranges are considered less suitable.

Maintaining representation in the form of genetic or ecological diversity is important to maintain the Texas hornshell's capacity to adapt to future environmental changes. Texas hornshell populations in the Rio Grande and Devils River (and, presumably, the Pecos River, due to its proximity to Rio Grande populations) have distinct variation in allele frequencies from those in the Black River (Inoue *et al.* 2015, p. 1916). We expect additional variation was present in Mexican populations. Mussels, like Texas hornshell, need to retain populations throughout their range to maintain the overall potential genetic and life-history attributes that can buffer the species' response to environmental changes over time (Jones *et al.* 2006, p. 531). The Texas hornshell has likely lost genetic diversity as populations have been extirpated. As such, maintaining the remaining representation in the form of genetic diversity may be important to the capacity of the Texas hornshell to adapt to future environmental change.

Finally, the Texas hornshell needs to have multiple resilient populations distributed throughout its range to provide for redundancy, the ability of the species to withstand catastrophic events. The more populations, and the wider the distribution of those populations, the more redundancy the species will exhibit. Redundancy reduces the risk that a large portion of the species' range will be negatively affected by a catastrophic natural or anthropogenic event at a given point in time. Species that are well-distributed

across their historical range are considered less susceptible to extinction and have higher viability than species confined to a small portion of their range (Carroll *et al.* 2010, entire; Redford *et al.* 2011, entire).

### **Summary of Biological Status and Threats**

The Act directs us to determine whether any species is an endangered species or a threatened species because of any factors affecting its continued existence. We completed a comprehensive assessment of the biological status of the Texas hornshell, and prepared a report of the assessment, which provides a thorough account of the species' overall viability. In this section, we summarize the conclusions of that assessment, which can be accessed at Docket No. FWS-R2-ES-2016-0077 on <http://www.regulations.gov>.

#### *Risk Factors*

We reviewed the potential risk factors (i.e., threats, stressors) that could be affecting the Texas hornshell now and in the future. In this proposed rule, we will discuss only those factors in detail that could meaningfully impact the status of the species. Those risks that are not known to have effects on Texas hornshell populations, such as collection and disease, are not discussed here. The primary risk factors (i.e., threats) affecting the status of the Texas hornshell are: (1) Increased fine sediment (Factor A from the Act), (2) water quality impairment (Factor A), (3) loss of flowing water (Factor A), (4) barriers to fish movement (Factor E), and (5) increased predation (Factor C). These factors are all exacerbated by climate change. Finally, we reviewed the conservation efforts being undertaken for the species.

## Increased Fine Sediment

Texas hornshell require seams of fine sediment under boulders and bedrock and in streambanks in order to anchor themselves into place on the stream bottom; however, too much fine sediment can fill in these crevices and smother any mussels within those spaces. Under natural conditions, fine sediments collect on the streambed and in crevices during low flow events, and they are washed downstream during high flow events (also known as cleansing flows). However, the increased frequency of low flow events (from groundwater extraction, instream surface flow diversions, and drought), combined with a decrease in cleansing flows (from reservoir management and drought), has caused sediment to accumulate to some degree at all populations. When water velocity decreases, which can occur from reduced streamflow or inundation, water loses its ability to carry sediment in suspension; sediment falls to the substrate, eventually smothering mussels that cannot adapt to soft substrates (Watters 2000, p. 263). Sediment accumulation can be exacerbated when there is a simultaneous increase in the sources of fine sediments in a watershed. In the range of Texas hornshell, these sources include streambank erosion from agricultural activities, livestock grazing, and roads, among others.

Interstitial spaces (small openings between rocks and gravels) in the substrate provide essential habitat for juvenile mussels. Juvenile freshwater mussels burrow into interstitial substrates, making them particularly susceptible to degradation of this habitat feature. When clogged with sand or silt, interstitial flow rates and spaces may become reduced (Brim Box and Mossa 1999, p. 100), thus reducing juvenile habitat availability.

All populations of Texas hornshell face the risk of fine sediment accumulation to varying degrees. Elimination of Texas hornshell from mussel beds due to large amounts of sediment deposition has been documented on the Black River in two locations in recent years. In the future, we expect this may continue to occur sporadically. Fine sediments are also accumulating at the Rio Grande—Laredo population. Low water levels on the Devils River will likely lead to additional sediment accumulation at this population, as well. In the future, we expect lower flows to occur more often at all populations and for longer periods due to climate change.

#### Water Quality Impairment

Water quality can be impaired through contamination or alteration of water chemistry. Chemical contaminants are ubiquitous throughout the environment and are a major reason for the current declining status of freshwater mussel species nationwide (Augsburger *et al.* 2007, p. 2025). Chemicals enter the environment through both point and nonpoint discharges, including spills, industrial sources, municipal effluents, and agricultural runoff. These sources contribute organic compounds, heavy metals, pesticides, herbicides, and a wide variety of newly emerging contaminants to the aquatic environment. Ammonia is of particular concern below water treatment plants because freshwater mussels have been shown to be particularly sensitive to increased ammonia levels (Augsburger *et al.* 2003, p. 2569). It is likely for this reason that Texas hornshell are not found for many miles downstream of two wastewater treatment plants that discharge into the Rio Grande: at Nuevo Laredo, Mexico, and at Eagle Pass, Texas (Karatayev *et al.* 2015, p. 14).

An additional type of water quality impairment is alteration of water quality parameters such as dissolved oxygen, temperature, and salinity levels. Dissolved oxygen levels may be reduced from increased nutrients in the water column from runoff or wastewater effluent, and juveniles seem to be particularly sensitive to low dissolved oxygen (Sparks and Strayer 1998, pp. 132–133). Increased water temperature from climate change and from low flows during drought can exacerbate low dissolved oxygen levels as well as have its own effects on both juvenile and adult mussels. Finally, salinity appears to be particularly limiting to Texas hornshell. The aquifer near Malaga, New Mexico, contains saline water. As the saline water emerges from the ground, it is diluted by surface flow. As surface flow decreases, however, the concentration of salinity in the river increases. Additionally, aquifers have become increasingly saline due to salinized water recharge (Hoagstrom 2009, p. 35). Irrigation return flows exacerbate salinity levels as salts build up on irrigated land and then are washed into the riverway. The Pecos River from the confluence with the Black River to the confluence with Independence Creek has become particularly saline in the past few decades, with levels at 7 parts per million (ppm) or higher, which is too high for freshwater mussel habitation. Additionally, the Black River downstream of the Texas hornshell population has had salinity levels in the range of 6 ppm, which may be one reason the population has been extirpated from the downstream reach.

Contaminant spills are also a concern. In particular, the Black River population is vulnerable to spills from the high volume of truck traffic crossing the river at low water access points (Bren School of Environmental Management 2014, p. 26). Due to the topography and steep slopes of these areas, spilled contaminants and contaminated soils

could directly enter the surface water of the river and negatively impact the species (Boyer 1986, p. 300) and downstream habitat. For the smaller populations (Black, Devils, Pecos rivers), a single spill could eliminate the entire population.

A reduction in surface flow from drought, instream diversion, or groundwater extraction concentrates contaminant and salinity levels, increases water temperatures in streams, and exacerbates effects to Texas hornshell.

Poor water quality affects most Texas hornshell populations currently to some degree, and future water quality is expected to decrease due to decreasing river flow and increasing temperatures. The Pecos River experiences very high salinity levels upstream of the existing population, and we expect that the observed high mortality of the Pecos River population is due to salinity pulses. Rangelwide, as water flow is expected to decrease due to climate change, water quality will decline.

#### Loss of Flowing Water

Texas hornshell populations need flowing water in order to survive. Low flow events (including stream drying) and inundation can eliminate appropriate habitat for Texas hornshell, and while the species can survive these events if they last for a short time, populations that experience these events regularly will not persist.

Inundation has primarily occurred upstream of dams, both large (such as Amistad, Falcon, and Red Bluff Dams) and small (low water crossings and diversion dams, such as those on the Black River). Inundation causes an increase in sediment deposition, eliminating the crevices this species inhabits. In large reservoirs, deep water is very cold and often devoid of oxygen and necessary nutrients. Cold water (less than 11 degrees Celsius (°C) (52 degrees Fahrenheit (°F))) has been shown to stunt mussel growth

(Hanson *et al.* 1988, p. 352). Because glochidial release may be temperature dependent, it is likely that relict individuals living in the constantly cold hypolimnion (deepest portion of the reservoir) in these reservoirs may never reproduce, or reproduce less frequently. Additionally, the effects of these reservoirs extend beyond inundation and fragmentation of populations; the reservoirs are managed for flood control and water delivery, and the resultant downstream releases rarely mimic natural flow regimes, tempering the natural fluctuations in flow that flush fine sediments from the substrate.

At the Rio Grande—Laredo population, a low-water weir has been proposed for construction (Rio Grande Regional Water Planning Group 2016, p. 8-8). The dam would be located just downstream of the La Bota area, which contains the largest known and most dense Texas hornshell bed within the Rio Grande—Laredo population and rangewide. The impounded area would extend approximately 14 mi (22.5 km) upstream, effectively eliminating habitat for Texas hornshell from 25 percent of the currently occupied area and likely leading to extirpation of the densest sites within this population.

Very low water levels are detrimental to Texas hornshell populations, as well. Effects of climate change have already begun to affect the regions of Texas and New Mexico where the Texas hornshell occurs, resulting in higher air temperatures, increased evaporation, increased groundwater pumping, and changing precipitation patterns such that water levels rangewide have already reached historic lows (Dean and Schmidt 2011, p. 336; Bren School of Environmental Management 2014, p. 50). The rivers inhabited by Texas hornshell have some resiliency to drought because they are spring-fed (Black and Devils Rivers) and very large (Rio Grande), but drought in combination with increased groundwater pumping and regulated reservoir releases may lead to lower river flows of

longer duration than have been recorded in the past. Streamflow in the Rio Grande downstream of the confluence with the Rio Conchos (near the Rio Grande—Lower Canyons population) has been declining since the 1980s (Miyazono *et al.* 2015, p. A-3), and overall river discharge for the Rio Grande is projected to continue to decline due to increased drought as a result of climate change (Nohara *et al.* 2006, p. 1087). The Rio Conchos contributes more than 90 percent of the flow of the lower Rio Grande (Dean and Schmidt 2011, p. 4). However, during times of drought (such as between 1994 and 2003), Mexico has fallen short of its water delivery commitments, and so the contribution of the Rio Conchos has fallen to as low as 40 percent (Carter *et al.* 2015, p. 15). The Rio Grande—Lower Canyons population is downstream of the confluence with the Rio Conchos and is at risk from these reduced deliveries. The Rio Grande—Lower Canyons is very incised (in other words, has vertical banks), and the population occurs in crevices along the steep banks. Due to the habitat characteristics of this population, reductions in discharge in this area may lead to a higher proportion of the Texas hornshell population being exposed than would be found in other populations experiencing similar flow decreases.

In the Black River, surface water is removed from the river for irrigation, including the Carlsbad Irrigation District's Black River Canal at the diversion dam. Studies have shown that flows in the river are affected by groundwater withdrawals, particularly those from the Black River Valley. Groundwater in the Black River watershed is also being used for hydraulic fracturing for oil and gas activities. Between 4.3 acre-feet (187,308 ft<sup>3</sup> (5,304 m<sup>3</sup>)) and 10.7 acre-feet (466,091 ft<sup>3</sup> (13,198 m<sup>3</sup>)) of water is used for each hydraulic fracturing job (Bren School of Environmental

Management 2014, p. 91). Overall, mean monthly discharge has already declined since the mid-1990s, and mean monthly temperatures have increased over the past 100 years (Inoue *et al.* 2014, p. 7). In the Black River, survivorship is positively correlated with discharge (Inoue *et al.* 2014, p. 9); as mean monthly discharge decreases, we expect Texas hornshell survivorship to decrease, as well. The Black River is expected to lose streamflow in the future due to air temperature increases, groundwater extraction, and reduced precipitation.

In the Devils River, future water withdrawals from aquifers that support spring flows in the range of the Texas hornshell could result in reduction of critical spring flows and river drying. In particular, there have been multiple proposals to withdraw water from the nearby aquifer and deliver the water to municipalities (e.g., Val Verde Water Company 2013, pp. 1–2). To date, however, none have been approved.

As spring flows decline due to drought or groundwater lowering from pumping, habitat for the Texas hornshell is reduced and could eventually cease to exist. While Texas hornshell may survive short periods of low flow, as low flows persist, mussels face oxygen deprivation, increased water temperature, and, ultimately, stranding.

#### Barriers to Fish Movement

Two of the Texas hornshell's primary host fish species (river carpsucker and red shiner) are known to be common, widespread species. We do not expect the distribution of host fish to be a limiting factor in Texas hornshell distribution. However, the barriers that prevent fish movement upstream and downstream affect the viability of Texas hornshell.

Texas hornshell were likely historically distributed throughout the Rio Grande, Pecos River, Devils River, and Black River in Texas and New Mexico, as well as throughout the rivers draining to the Gulf of Mexico from which the species was known when few natural barriers existed to prevent migration (via host species) among suitable habitats. The species colonized new areas through movement of infested host fish, and newly metamorphosed juveniles would excyst from host fish in new locations. Today, the remaining populations are significantly isolated from one another such that recolonization of areas previously extirpated is extremely unlikely if not impossible due to existing contemporary barriers to host fish movement. The primary reason for this isolation is reservoir construction and unsuitable water quality. The Black River is isolated from the rest of the populations by high salinity reaches of the Pecos River, as well as Red Bluff Reservoir, and is hundreds of river miles from the nearest extant population. Amistad Reservoir separates the three Texas populations from each other, isolating the Rio Grande—Lower Canyons, Devils River, and Rio Grande—Laredo populations. There is currently no opportunity for interaction among any of the five extant U.S. populations.

The overall distribution of mussels is, in part, a function of the dispersal of their host fish. Small populations are more affected by this limited immigration potential because they are susceptible to genetic drift (random loss of genetic diversity) and inbreeding depression. At the species level, populations that are eliminated due to stochastic events cannot be recolonized naturally, leading to reduced overall redundancy and representation.

Increased Predation

Predation on freshwater mussels is a natural ecological interaction. Raccoons, snapping turtles, and fish are known to prey upon Texas hornshell. Under natural conditions, the level of predation occurring within Texas hornshell populations is not likely to pose a significant risk to any given population. However, during periods of low flow, terrestrial predators have increased access to portions of the river that are otherwise too deep under normal flow conditions. High levels of predation during drought have been observed on the Devils River, and muskrat predation has also been reported on the Black River. As drought and low flow conditions are predicted to occur more often and for longer periods due to the effects of climate change, the Black and Devils Rivers are expected to experience additional predation pressure into the future. Predation is expected to be less of a concern for the Rio Grande populations, as the river is significantly larger than the Black and Devils Rivers and Texas hornshell are less likely to be found in exposed or very shallow portions of the stream.

#### Effects of Climate Change

Climate change in the form of the change in timing and amount of precipitation and air temperature increase is occurring, and continued greenhouse gas emissions at or above current rates will cause further warming (Intergovernmental Panel on Climate Change (IPCC) 2013, pp. 11–12). Warming in the Southwest is expected to be greatest in the summer (IPCC 2013, pp. 11–12), and annual mean precipitation is very likely to decrease in the Southwest (Ray *et al.* 2008, p. 1; IPCC 2013, pp. 11–12). In Texas, the number of extreme hot days (high temperatures exceeding 95 °F (35 °C) are expected to double by around 2050 (Kinniburgh *et al.* 2015, p. 83), and Texas is considered one of the “hotspots” of climate change in North America; west Texas is an area expected to

show greater responsiveness to the effects of climate change (Diffenbaugh *et al.* 2008, p. 3). Even if precipitation and groundwater recharge remain at current levels, increased groundwater pumping and resultant aquifer shortages due to increased temperatures are nearly certain (Loaiciga *et al.* 2000, p. 193; Mace and Wade 2008, pp. 662, 664-665; Taylor *et al.* 2012, p. 3). Increased water temperature can cause stress to individuals, decrease dissolved oxygen levels, and increase toxicity of contaminants. Effects of climate change, such as air temperature increases and an increase in drought frequency and intensity, have been shown to be occurring throughout the range of Texas hornshell (Kinniburgh *et al.* 2015, p. 88), and these effects are expected to exacerbate several of the stressors discussed above, such as water temperature and flow loss (Wuebbles *et al.* 2013, p. 16). As we projected the future condition of the Texas hornshell and which stressors are likely to occur, we considered climate change to be an exacerbating factor in the increase of fine sediments, changes in water quality, and loss of flowing water.

Due to the effects of ongoing climate change, we expect the frequency and duration of cleansing flows to decrease, leading to the increase in fine sediments and reduced water levels at all populations. More extreme climate change projections lead to further increases in fine sediment within the populations. Similarly, as lower water levels concentrate contaminants and cause unsuitable temperature and dissolved oxygen levels, we expect water quality to decline to some degree in the future.

#### *Conservation Actions and Regulatory Mechanisms*

About 7 percent of known occupied habitat for the Texas hornshell is in New Mexico, and the Service is collaborating with water users, oil and gas developers, landowners, and other partners to develop candidate conservation agreements (CCAs) for

the species on State, Federal, and private lands. These agreements are currently under development, and the potential purpose is to provide voluntary conservation that would reduce threats to the species while improving physical habitat and water quality. The key conservation measures in the agreements will be designed to limit oil and gas development to areas outside of the Black and Delaware River floodplains, minimize erosion, and maintain minimum water flows in the rivers. Along with these measures, the partners to the agreement are evaluating alternatives to the multiple low water crossings on the Black River. Partners are considering alternate crossing locations, which could include bridges designed to allow host fishes to pass through in addition to decreasing potential contamination events. Because these agreements have not been completed, we are not considering the conservation actions in our present evaluation of the status of Texas hornshell.

The New Mexico Department of Game and Fish has begun Texas hornshell reintroduction efforts into the Delaware River, which is within the historical range of the species. Adults and infested host fish were released in suitable habitat in the Delaware River in 2013 and 2015. Many of the released adults have been subsequently located, and success of the reintroduction will be determined in the coming years. We expect the reintroduction effort to continue over the next several years, but we are not considering the action to have been successful to date.

In Texas, The Nature Conservancy and Texas Parks and Wildlife Department manage lands under their purview in the Devils River watershed for native communities, including Texas hornshell. The large amount (over 200,000 acres) of land in

conservation management in the Devils River watershed reduces the risks to Texas hornshell from sediment inputs and contaminants.

In the Rio Grande, we are not aware of any management actions for Texas hornshell. The Texas Comptroller of Public Accounts has established an Endangered Species Task Force and has funded much of the recent research in Texas on Texas hornshell, which has led to greater understanding of the species' distribution in the State.

#### *Current Condition*

Overall, there are five known remaining populations of Texas hornshell, comprising approximately 15 percent of the species' historical range in the United States (see Map 1, above). Historically, most Texas hornshell populations were likely connected by fish migration throughout the Rio Grande, upstream through the Pecos River, and throughout the tributaries, but due to impoundments and river reaches with unsuitable water quality (for example, high salinity) they are currently isolated from one another, and repopulation of extirpated locations is unlikely to occur without human assistance. Here we discuss the current condition of each known population, taking into account the risks to those populations that are currently occurring, as well as management actions that are currently occurring to address those risks. We consider low levels of climate change to be currently occurring, resulting in reduced timing and amount of streamflow, increased stream temperatures, and increased accumulation of fine sediments.

**Black River:** The Black River population is quite dense and recruitment appears to be high, but the short size (8.7 mi (14.0 km)) of the occupied reach limits this population's resiliency. Accumulation of fine sediment in the substrate has already

occurred due to increased sediment input into the river from road crossings, culverts, and cattle grazing, combined with a decreased frequency of cleansing river flows. The current level of climate change will continue to reduce flow in the river from groundwater extraction and drought, resulting in fewer cleansing flows and increased fine sediments. The distribution of Texas hornshell in the Black River will remain small, and the risk of a contaminant spill will remain high, resulting in a high likelihood that water quality will become unsuitable and reduce abundance of Texas hornshell significantly. Therefore, taking into account the current threats to the population and its distribution within the river, the Texas hornshell population in the Black River has low resiliency.

Pecos River: The Pecos River population is extremely small and exhibits no evidence of reproduction. The few number of live individuals among the very high number of dead shells indicates a population in severe decline; this is likely due to high salinity levels in the river upstream of the population. There is a high likelihood this population will be extirpated in the near future due to water quality alone. Therefore, the Pecos River population of Texas hornshell has very low resiliency.

Devils River: The Devils River population has low abundance and has exhibited some evidence of reproduction. The current level of climate change will continue to reduce flow in the Devils River due to groundwater extraction and drought. The low flows this population experiences during dry times will continue to become more frequent and prolonged. Because Texas hornshell in the Devils River occur at the heads of riffles, they are vulnerable to complete flow loss when water levels drop. The reduction in cleansing flows will also result in the accumulation of fine sediments, reducing substrate quality. Low flows will also affect water quality parameters such as

temperature and dissolved oxygen, causing them to become unsuitable for Texas hornshell. Additionally, the species is already vulnerable to predation from terrestrial predators during times of low flow; predation will occur more frequently as periods of low flow become more common. Overall, because the population is currently small and would be unlikely to grow, the Devils River population has low resiliency.

Rio Grande—Lower Canyons: The Lower Canyons population has relatively high abundance and evidence of recruitment. Drought and groundwater extraction resulting from currently observed levels of climate change will continue to lower water levels in the Rio Grande—Lower Canyons population of Texas hornshell. We expect that Mexico's management of the Rio Conchos will continue to be an unreliable source of water. This section of the Rio Grande is relatively deep and incised, and the population of Texas hornshell primarily occurs in crevices along the banks. Water flow reductions would expose a high proportion of the existing population; therefore, this reduction in flow will likely have a larger effect on the population size than in other populations, although at a small to moderate decrease in water flow we still expect abundance to be maintained at moderate levels. Overall, the Rio Grande—Lower Canyons population exhibits moderate resiliency.

Rio Grande—Laredo: Similar to the Lower Canyons population, the Laredo population has numerous mussel beds with high Texas hornshell abundance and evidence of reproduction. However, drought and upstream water management will continue to reduce flows in the Rio Grande. Water quality will continue to decrease due to lower flows, and fine sediments will accumulate. Declining water flow will cause fine

sediments to accumulate and water quality to decline, leading to a decline in population abundance. Overall, the Rio Grande—Laredo has moderate resiliency.

Mexico: We have low confidence in the species' current condition throughout most of the Mexican range. One or more of these populations may still be extant, or they may all be extirpated. We have no recent data on the species' occurrence in Mexico; the last live recordings are from the mid-1980s. Because of this uncertainty, we did not rely on the Texas hornshell's distribution in Mexico when evaluating the viability of the species.

#### *Future Condition*

As part of the SSA, we also developed multiple future condition scenarios to capture the range of uncertainties regarding future threats and the projected responses by the Texas hornshell. Our scenarios included a status quo scenario, which incorporated the current risk factors continuing on the same trajectory that they are on now. We also evaluated four additional future scenarios that incorporated varying levels of increasing risk factors with elevated negative effects on hornshell populations. However, because we determined that the current condition of the Texas hornshell and the associated status quo projections were consistent with an endangered species (see **Determination**, below), we are not presenting the results of the other future scenarios in this proposed rule. The additional future scenarios project conditions that are worse for the Texas hornshell. Since the status quo scenario was determined to be endangered, other projected scenarios would also be endangered, as they forecast conditions that are more at risk of extinction than the status quo. Please refer to the SSA report (Service 2016) for the full analysis of future scenarios.

## **Determination**

Section 4 of the Act, and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(b)(1)(a), the Secretary is to make endangered or threatened determinations required by subsection 4(a)(1) solely on the basis of the best scientific and commercial data available to her after conducting a review of the status of the species and after taking into account conservation efforts by States or foreign nations. The standards for determining whether a species is endangered or threatened are provided in section 3 of the Act. An endangered species is any species that is “in danger of extinction throughout all or a significant portion of its range.” A threatened species is any species that is “likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” Per section 4(a)(1) of the Act, in reviewing the status of the species to determine if it meets the definition of endangered or of threatened, we determine whether any species is an endangered species or a threatened species because of any of the following 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; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination.

The fundamental question before the Service is whether the species warrants protection as an endangered or threatened species under the Act. To make this

determination, we evaluated extinction risk, described in terms of the current condition of populations and their distribution (taking into account the risk factors (i.e., threats, stressors) and their effects on those populations). For any species, as population conditions decline and distribution shrinks, the species' overall viability declines and extinction risk increases.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Texas hornshell. Our analysis of the past, current, and future influences on what the Texas hornshell needs for long-term viability revealed that there are five influences that may pose a meaningful risk to the viability of the species. These are primarily related to habitat changes (Factor A from the Act): the accumulation of fine sediments, the loss of flowing water, and impairment of water quality, all of which are exacerbated by the effects of climate change. Predation (Factor C) is also affecting those populations already experiencing low stream flow, and barriers to fish movement (Factor E) prevent recolonization after stochastic events.

The Texas hornshell has declined significantly in overall distribution and abundance, with the species currently occupying approximately 15 percent of its historical range in the United States. Between one-half and two-thirds of the Texas hornshell's historical range occurred in Mexico; we have very low confidence in the species' current condition throughout most of the Mexican range. The resulting remnant populations occupy shorter reaches compared to presumed historical populations, and they are all isolated from one another.

The primary historical reason for this reduction in range was reservoir construction and unsuitable water quality. Large reservoirs have been constructed on the Rio Grande and Pecos River, and much of the Pecos River upstream of the confluence with Independence Creek now has salinity levels too high for mussel habitation (Hoagstrom 2009, p. 28). The effects of these reservoirs extend beyond fragmentation of populations; the resultant downstream water releases do not mimic natural flow regimes, and the change in timing and frequency of cleansing flows results in increases in fine sediments, increases in predation, and decreases in water quality. Add to this the exacerbating effects of climate change—increased temperature and decreased stream flow—and the remaining Texas hornshell populations face moderate to high levels of risk of extirpation currently. For the populations occupying the smaller reaches (such as the Black River, Devils River, and Pecos River populations), a single stochastic event such as contaminant spill or drought could eliminate an entire population of Texas hornshell. These effects are heightened at the species level because the isolation of the populations prohibits natural recolonization from host fish carrying Texas hornshell glochidia, which likely happened in the past and allowed for the species to ebb and flow from suitable areas.

Populations in both large and small reaches face risks from natural and anthropogenic sources. Climate change has already begun to affect the regions of Texas and New Mexico where Texas hornshell occurs, resulting in higher air temperatures, increased evaporation, increased groundwater pumping, and changing precipitation patterns such that water levels rangewide have already reached historic lows. These low

water levels put the populations at risk of habitat loss from increased fine sediments, poor water quality, and increased predation risk.

These risks, alone or in combination, are expected to result in the extirpation of additional populations, further reducing the overall redundancy and representation of the species. Historically, the species, with a large range of interconnected populations, would have been resilient to stochastic events such as drought and sedimentation because even if some populations were extirpated by such events, they could be recolonized over time by dispersal from nearby surviving populations. This connectivity would have made for a highly resilient species overall. However, under current conditions, connectivity is prevented due to large reservoirs and unsuitably high salinity levels between populations. As a consequence of these current conditions, the viability of the Texas hornshell now primarily depends on maintaining the remaining isolated populations.

Of the five remaining isolated populations, three are small in abundance and occupied stream length and have low to no resiliency. The remaining two are larger, with increased abundance and occupied stream length; however, flow reduction, water quality decline, and habitat loss from sedimentation reduce the abundance and distribution of those populations. We have no information on population status in Mexico. Therefore, the Texas hornshell has no populations that are currently considered highly resilient. The high risk of extirpation of these populations leads to low levels of redundancy (few populations will persist to withstand catastrophic events) and representation (little to no ecological or genetic diversity will persist to respond to changing environmental conditions). Overall, these low levels of resiliency, redundancy, and representation result

in the Texas hornshell having low viability, and the species currently faces a high risk of extinction.

The Act defines an endangered species as any species that is “in danger of extinction throughout all or a significant portion of its range” and a threatened species as any species “that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.” We find that the Texas hornshell is presently in danger of extinction throughout its entire range based on the severity and immediacy of threats currently impacting the species. The overall range has been significantly reduced, and the remaining habitat and populations are threatened by a multitude of factors acting in combination to reduce the overall viability of the species. The risk of extinction is high because the remaining populations have a high risk of extirpation, are isolated, and have limited potential for recolonization. Therefore, on the basis of the best available scientific and commercial information, we propose listing the Texas hornshell as endangered in accordance with sections 3(6) and 4(a)(1) of the Act. We find that a threatened species status is not appropriate for the Texas hornshell because of the currently contracted range (loss of 85 percent of its historic range in the United States, and likely more in Mexico), because the threats are occurring across the entire range of the species, and because the threats are ongoing currently and are expected to continue or worsen into the future. Because the species is already in danger of extinction throughout its range, a threatened status is not appropriate.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. Because we have determined that the Texas hornshell is endangered throughout all of its range, no

portion of its range can be “significant” for purposes of the definitions of “endangered species” and “threatened species.” See 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).

### **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. Subsection 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 includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan also identifies recovery criteria for review of when a species may be ready for downlisting or 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 Texas Coastal Ecological Services 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 ranges 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 Texas and New Mexico would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Texas hornshell. Information on our grant programs that are available to aid species recovery can be found at: <http://www.fws.gov/grants>.

Although the Texas hornshell 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 or consultation or both as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the Bureau of Land Management, Bureau of Reclamation, and National Park Service; issuance of section 404 Clean Water Act (33 U.S.C. 1251 et seq.) permits by the U.S. Army Corps of Engineers; and construction and maintenance of roads or highways by the Federal Highway Administration.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to endangered wildlife. The prohibitions of section 9(a)(1) of the Act, codified at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these) endangered wildlife within the United States or on the high seas. In addition, it is unlawful to import; export; deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to employees of the Service, the National Marine Fisheries Service, other Federal land management agencies, and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered wildlife under certain circumstances. Regulations governing permits are

codified at 50 CFR 17.22. With regard to endangered wildlife, a permit may be issued for the following purposes: for scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities. There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

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. Based on the best available information, if we list this species, the following actions are unlikely to result in a violation of section 9, if these activities are carried out in accordance with existing regulations and permit requirements; this list is not comprehensive:

(1) Normal agricultural and silvicultural practices, including herbicide and pesticide use, which are carried out in accordance with any existing regulations, permit and label requirements, and best management practices; and

(2) Normal residential landscape activities.

Based on the best available information, if we list this species, the following activities may potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized handling or collecting of the species;

(2) Modification of the channel or water flow of any stream in which the Texas hornshell is known to occur;

(3) Livestock grazing that results in direct or indirect destruction of stream habitat; and

(4) Discharge of chemicals or fill material into any waters in which the Texas hornshell is known to occur.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Texas Coastal Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

### **Critical Habitat for the Texas Hornshell**

#### *Background*

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features:

(a) Essential to the conservation of the species, and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer

necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the consultation requirements of section 7(a)(2) of the Act would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the landowner is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General

Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines, provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate 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 designate critical habitat at the time the species is determined to be endangered or threatened. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species.

There is currently no imminent threat of take attributed to collection or vandalism under Factor B for the Texas hornshell, and identification and mapping of critical habitat is not likely to increase any such threat. In the absence of finding that the designation of critical habitat would increase threats to a species, if there are any benefits to a critical habitat designation, then a prudent finding is warranted. The potential benefits of designation include: (1) Triggering consultation under section 7 of the Act in new areas for actions in which there may be a Federal nexus where it would not otherwise occur because, for example, it is or has become unoccupied or the occupancy is in question; (2)

focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or county governments or private entities; and (4) preventing people from causing inadvertent harm to the species. Therefore, because we have determined that the designation of critical habitat will not likely increase the degree of threat to these species and may provide some measure of benefit, we find that designation of critical habitat is prudent for the Texas hornshell.

#### *Critical Habitat Determinability*

Having determined that designation is prudent, under section 4(a)(3) of the Act we must find whether critical habitat for the species 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: (1) Information sufficient to perform required analyses of the impacts of the designation is lacking, or (2) the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.

As discussed above, we have reviewed the available information pertaining to the biological needs of this species and habitat characteristics where this species is located. Because the biological needs are not sufficiently well known to permit identification of critical habitat, we are seeking additional information regarding updated occurrence records for the Texas hornshell, future climate change effects on the species' habitat, and other analyses. Therefore, we conclude that the designation of critical habitat is not determinable for the Texas hornshell at this time. We will make a determination on critical habitat no later than 1 year following any final listing determination.

#### **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.)*

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

### **References Cited**

A complete list of references cited is available in Appendix A of the SSA

Report (U.S. Fish and Wildlife Service. 2016. Species status assessment report for the Texas hornshell (*Popenaias popeii*), Version 1.0. Albuquerque, NM), available online at <http://www.regulations.gov>, under Docket Number FWS–R2–ES–2016–0077.

**Authors**

The primary authors of this proposed rule are the staff members of the Texas Coastal Ecological Services Field Office.

**List of Subjects in 50 CFR Part 17**

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

**Proposed Regulation Promulgation**

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 “Hornshell, Texas” to the List of Endangered and Threatened Wildlife in alphabetical order under Clams:

**§ 17.11 Endangered and threatened wildlife.**

\* \* \* \* \*

(h) \* \* \*

Common Name	Scientific Name	Where Listed	Status	Listing Citations and Applicable Rules
* * * * *				
CLAMS				
* * * * *				
Hornshell, Texas	<i>Popenaias popeii</i>	Wherever found	E	[ <u>Federal Register citation when published as a final rule</u> ]
* * * * *				

Dated: July 21, 2016.

Signed: Stephen Guertin

*Acting Director, U.S. Fish and Wildlife Service.*

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