DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2015–0148]

[4500030113]

RIN 1018–BA86

Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Headwater Chub and a Distinct Population Segment of the Roundtail Chub

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to list the headwater chub (*Gila nigra*) and a distinct population segment (DPS) of the roundtail chub (*Gila robusta*)

from the lower Colorado River basin as threatened species under the Endangered Species Act (Act). If we finalize this rule as proposed, it would extend the Act's protections to this species and DPS.

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–2015–0148, which is the docket number for this rulemaking. Then click on the Search button. On the resulting page, 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–2015–0148, 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: Steve Spangle, Field Supervisor, U.S. Fish and Wildlife Service, Arizona Ecological Services Office, 2321 West Royal Palm Road, Suite 103, Phoenix, AZ 85021**;** telephone 602-242-0210. 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. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

This rule proposes to list the headwater chub and the lower Colorado River basin roundtail chub DPS as threatened species. The headwater and lower Colorado River basin roundtail chub DPS

are 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 rule reassesses all available information regarding the status of and threats to the headwater chub and lower Colorado River basin roundtail chub DPS.

The basis for our action. Under the Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that headwater chub and lower Colorado River basin roundtail chub DPS meet the definition of threatened species primarily because of the present or threatened destruction of their habitat or range and other natural or manmade factors resulting mainly from impacts from nonnative aquatic species, reduction of habitat (i.e., water availability), and climate change.

We will seek peer review. We will seek comments from independent specialists to ensure that our determinations are 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 determinations may differ from this proposal.

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 headwater and roundtail chubs' 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, their habitats, 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 these 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 these species, including the locations of any additional populations of these species.

(5) Information as to which prohibitions, and exceptions to those prohibitions, are necessary and advisable to provide for the conservation of the headwater chub or the lower Colorado River basin roundtail chub DPS pursuant to section 4(d) of the Act (16 U.S.C. 1531 et seq.).

We are also seeking comments regarding potential critical habitat designation for the headwater chub and the lower Colorado River basin roundtail chub DPS. We particularly seek comments concerning:

(1) The reasons why we should or should not designate habitat as "critical habitat" under section 4 of the Act, including whether there are threats to the species from human activity, the degree of which can be expected to increase due to the designation, and whether that increase in threat outweighs the benefit of designation such that the designation of critical habitat may not be prudent.

(2) Specific information on:

(a) The amount and distribution of headwater chub and roundtail chub habitat;

(b) What areas, that were occupied at the time of listing (or are currently occupied) and that contain features essential to the conservation of the species, should be included in the designation and why;

(c) Special management considerations or protection that may be needed in critical habitat areas we are proposing, 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.

(3) Land use designations and current or planned activities in the subject areas and their possible impacts on critical habitat.

(4) Information on the projected and reasonably likely impacts of climate change on the headwater chub, the lower Colorado River basin roundtail chub DPS, and their habitats.

(5) Any probable economic, national security, or other relevant impacts of designating any area that may be included in the proposed critical habitat designation; in particular, we seek comments on any impacts on small entities or families, and the benefits of including or excluding areas that exhibit these impacts.

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 the **ADDRESSES** section. We request that you send comments only by the methods described in the **ADDRESSES** section.

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, Arizona 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 the **FOR FURTHER INFORMATION CONTACT** section. 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 expert opinions of at least three appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our listing determinations are based on scientifically sound data, assumptions, and analyses. The peer reviewers will have expertise in headwater and roundtail chub (or similar species) biology, life history, ecology, habitat, and other physical or biological factors.

Previous Federal Action

Headwater Chub

On December 30, 1982 (47 FR 58454), we placed the headwater chub (as *Gila robusta grahami*) on the list of candidate species as a category 2 species. Category 2 species were those for which information in the Service's possession indicated that proposing to list was possibly appropriate, but for which substantial biological data to support a proposed rule were lacking. Headwater chub retained its category 2 candidate status until the practice of identifying category 2 candidates was discontinued in the candidate notice of review (CNOR) published on February 28, 1996 (61 FR 7596). At that time, the headwater chub was removed from the candidate list and no longer recognized under the Act.

On April 14, 2003, we received a petition from the Center for Biological Diversity to list the headwater chub (*Gila nigra*) as endangered or threatened and to designate critical habitat concurrently with the listing. Following receipt of the 2003 petition, and pursuant to a stipulated settlement agreement, we published a 90–day finding on July 12, 2005 (70 FR 39981), in which we found that the petitioners had provided sufficient information to indicate that listing of the headwater chub may be warranted. On May 3, 2006, we published our 12–month finding (71 FR 26007) that listing was warranted, but precluded by higher priority listing actions, for the headwater chub. The species was subsequently included in all of our CNORs from 2006 through 2014 (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).

Lower Colorado River Basin Roundtail Chub DPS

On December 30, 1982 (47 FR 58455), the roundtail chub was placed on the list of candidate species as a category 2 species. Roundtail chub retained its category 2 candidate status until the practice of identifying category 2 candidates was discontinued in the 1996 CNOR (61 FR 7596; February 28, 1996). At that time, the roundtail chub was removed from the candidate list and no longer recognized under the Act.

On April 14, 2003, we received a petition from the Center for Biological Diversity to list a distinct population segment (DPS) of the roundtail chub (*Gila robusta*) in the lower Colorado River basin (defined as all waters tributary to the Colorado River in Arizona and the portion of New Mexico in the Gila River and Zuni River basins) as endangered or threatened and to designate critical habitat concurrently. Following receipt of the 2003 petition, and pursuant to a stipulated settlement agreement, we published our 90–day finding on July 12, 2005 (70 FR 39981), that the petition presented substantial scientific information indicating that listing a DPS of the roundtail chub in the lower Colorado River basin may be warranted.

On May 3, 2006, we published our 12–month finding (71 FR 26007) that listing of a DPS of the roundtail chub in the lower Colorado River basin was not warranted because it did not meet our definition of a DPS. On September 7, 2006, the Center for Biological Diversity

challenged our decision not to list the lower Colorado River basin population of the roundtail chub as an endangered species under the Act. On November 5, 2007, in a stipulated settlement agreement, we agreed to commence a new status review of the lower Colorado River basin population segment of the roundtail chub and to submit a 12–month finding to the **Federal Register** by June 30, 2009.

On July 7, 2009, we published a 12–month finding (74 FR 32352) on a petition to list a DPS of roundtail chub and found that the population segment satisfies the discreteness and significance elements of the Interagency Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Act (DPS Policy) (February 7, 1996; 61 FR 4722), and qualifies as a DPS. We further concluded that listing of the lower Colorado River basin DPS was warranted but precluded due to higher priority listing actions at the time. The DPS was subsequently included in all of our CNORs from 2009 through 2014 (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).

The lower Colorado River basin DPS of roundtail chub is the candidate entity that is the subject of this proposed rule. The DPS includes the lower Colorado River and its tributaries downstream of Glen Canyon Dam, including the Gila and Zuni River basins in New Mexico.

Background

Species Information

Taxonomy

Headwater chub was first described as a subspecies, *G. grahami* or *G. robusta grahami*, from Ash Creek and the San Carlos River in east-central Arizona in 1874 (Cope and Yarrow 1875). In 2000, Minckley and DeMarais proposed full species status for headwater chub. The American Fisheries Society has accepted headwater chub (*Gila nigra*) as a full species (Nelson et al. 2004), as have the New Mexico Department of Game and Fish (Carmen 2006) and Arizona Game and Fish Department (Arizona Game and Fish Department 2006). As a consortium of fisheries scientists, the American Fisheries Society is the recognized and accepted scientific authority on fish taxonomy, and this is best commercial and scientific data available.

Roundtail chub (*Gila robusta*) was first described by Baird and Girard (1853) from specimens collected in 1851 from the Zuni River (tributary to Little Colorado River), although that location may not be correct as Smith et al. (1979) reported the type locality was likely the mainstem Little Colorado River and Sublette et al. (1990) suggested the specimens may have been collected from the Rio Pescado (tributary to Zuni River) and incorrectly cited as the Zuni River. Roundtail chub has been recognized as a distinct species since the 1800s.

Biology and Habitat

I. Headwater Chub Biology and Habitat

Headwater chubs are cyprinid fish (member of the minnow family Cyprinidae) with streamlined body shapes and are similar in appearance to the roundtail chub and the Gila chub (*Gila intermedia*). Adults range in size from 200–320 millimeters (mm) (8–12 inches (in)). Headwater chubs live for approximately 8 years and spawn from age 2 to 3 onward (Bestgen 1985, p. 65; Neve 1976, pp. 13, 15). Spawning typically occurs between April and May (Bestgen 1985, pp. 57-60; Brouder et al. 2000, pp. 12-13) but can occur as early as March (Neve 1976, pp. 13–14). Headwater chub are omnivorous, opportunistic feeders that consume plants, detritus, arthropods (aquatic and terrestrial), and fish.

Headwater chubs occur in the middle to upper reaches of medium- to large-sized streams (Minckley and DeMarais 2000, p. 255) that are considered cool to warm water streams. Habitats in the Gila River containing headwater chubs consist of tributary and mainstem habitats at elevations of 1,325 meters (m) (4,347 feet (ft)) to 2,000 m (6,562 ft) (Bestgen 1985, entire; Bestgen and Propst 1989, pp. 402–410). Typical adult habitats containing headwater chub consist of nearshore pools (greater than 1.8 m (6 ft.)), adjacent to swifter riffles and runs over sand and gravel substrate, with young-of-the-year and juveniles using smaller pools and areas with undercut banks and low velocity (Barrett 1992, p. 48; Barrett and Maughn 1995, p. 302; Bestgen and Propst 1989, pp. 402–410). Spawning typically occurs in pool-riffle areas with sandy-rocky substrates when water temperatures are between 17–22 degrees Celsius (˚C) (63–72 degrees Fahrenheit (˚F)) (Bonar et al. 2011, p. 10; Bestgen 1985, p. 64; Bonar et al. 2011, p. 11; Neve 1976, pp. 13–14). Snowmelt during late winter and early spring cues spawning and provides water temperatures suitable for spawning.

In the lower Colorado River basin, several chub species are closely related genetically and closely resemble each other morphologically. This is likely the result of multiple independent hybridization events over time (Rinne 1976; Rosenfeld and Wilkinson 1989; DeMarais et al. 1992; Dowling and DeMarais 1993; Minckley and DeMarais 2000; Gerber et al. 2001; Schwemm 2006; Schönhuth et al. 2014). Due to the similarities in morphology and genetics, identification of species in a stream is based on the geographic location of the stream in relation to other known chub streams. In headwater chub, most of their genetic variation occurs among populations, each of which tends to be distinctive. Genetic variation within headwater chub populations is consistent with the presumed multiple hybrid origins of this species (Dowling et al. 2008, p. 2).

II. Lower Colorado River Basin Roundtail Chub Biology and Habitat

Roundtail chub are similar in appearance to Gila chub and headwater chub. Adults range in size from 225–350 mm (9–14 in) in length. Roundtail chub average life span is 8–10 years (Bezzerides and Bestgen 2002, p. 21). Maturity of roundtail chub in the lower Colorado River population segment occurs between ages 3 and 5 years at 150–300 mm (6–12 in) (Bezzerides and Bestgen 2002, p. 21; Brouder et al. 2000, p. 12). In the lower Colorado River population segment, spawning occurs between April and May (Minckley 1981, p. 189; Bestgen 1985b, p. 7; Bryan et al. 2000, pp. 27–28; Bryan and Robinson 2000, pp. 20–21).

Roundtail chub are found in cool to warm waters of rivers and streams, and often occupy the deepest pools and eddies present in the stream (Minckley 1973, p. 101; Brouder et al. 2000, pp. 6–8; Minckley and DeMarais 2000, p. 255; Bezzerides and Bestgen 2002, pp. 17–19). Adult roundtail chub favor slow-moving, deep pools. For cover they use large rocks, undercut banks, and woody debris (Bezzerides and Bestgen 2002, p. 18; Brouder et al. 2000, pp. 6–7; Bryan and Hyatt 2004, p. 9). Spawning occurs in pool, run, and riffle habitats, with slow to moderate water velocities (Propst 1999, p. 24; Brouder et al. 2000, p. 12; Voeltz 2002, p. 16). Snowmelt during late winter and early spring cues spawning and provides water temperatures suitable for spawning. Roundtail chub larvae use low-velocity backwaters (Ruppert et al. 1993, p. 397). Young-of-the-year roundtail chub occupy shallow (less than 50 cm (20 in) depth) and low-velocity waters with vegetated shorelines (Brouder et al. 2000, pp. 6–8; Lanigan and Berry 1981, p. 392). Juveniles use habitat similar to young-of-the-year but with depths less than 100 cm (40 in). Water temperatures of habitats occupied by roundtail chub vary seasonally between 0–32˚C (32–90˚F) (Bezzerides and Bestgen 2002, p. 19; Bonar et al. 2010, p. 3).

There was historically greater connectivity and subsequent relatedness of roundtail chub over the lower Colorado River basin, and development of populations in isolation from other roundtail chub populations was not the normal condition across most of the historical range, except in the Bill Williams River and Little Colorado River drainages.

Roundtail Chub Lower Colorado River Distinct Population Segment

Section 3(16) of the Act defines "species" to include any species or subspecies of fish and wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature (16 U.S.C. 1532(16)). To interpret and implement the distinct population segment provisions of the Act and congressional guidance, the Service and the National Marine Fisheries Service (now the National Oceanic and Atmospheric Administration—Fisheries Service), published the Policy Regarding the Recognition of Distinct Vertebrate Population Segments (DPS Policy) in the **Federal Register** on February 7, 1996 (61 FR 4722). The DPS Policy sets forth a three-step process for considering if a population is a DPS: the Policy requires the Service first to determine whether a vertebrate population is discrete and, if the population is discrete, then to determine whether the population is significant. Lastly, if the population is determined to be both discrete and significant, then the DPS Policy requires the Service to evaluate the conservation status of the population to determine whether or not the DPS falls within the Act's definition of an "endangered species" or a "threatened species."

In accordance with our DPS Policy, this section details our analysis of whether the vertebrate population segment under consideration for listing qualifies as a DPS, specifically, whether: (1) The population segment is discrete from the remainder of the species to which it belongs; and (2) the population is significant to the species to which it belongs. In our July 7, 2009, 12-month finding for roundtail chub (74 FR 32352) we found that the roundtail chub in the lower Colorado River basin (the lower Colorado River and its tributaries downstream of Glen Canyon Dam, including the Gila and Zuni River basins in New Mexico) met the definition of a DPS. In the following sections, we reaffirm that finding.

Discreteness

Under the DPS Policy, a population segment of a vertebrate taxon may be considered discrete if it satisfies either one of the following conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (quantitative measures of genetic or morphological discontinuity may provide evidence of this separation); or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act. The potential DPS population of roundtail chub in the lower Colorado River basin is not delimited by international governmental boundaries. The following discussion considers whether the potential DPS population of roundtail chub in the lower Colorado River basin is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors.

The historical range of roundtail chub included both the upper and lower Colorado River basins in the States of Wyoming, Utah, Colorado, New Mexico, Arizona, and Nevada (Propst 1999, p. 23; Bezzerides and Bestgen 2002, p. 25; Voeltz 2002, pp. 9–23), but the roundtail chub was likely only a transient in Nevada, so Nevada is not considered part of its range. Currently, roundtail chubs occur in both the upper and lower Colorado River basins in Wyoming, Utah, Colorado, New Mexico, and Arizona. Bezzerides and Bestgen (2002, p. 24) concluded that historically there were two discrete population centers, one in each of the lower and upper basins, and that these two population centers remain today. Numerous authors have noted that

roundtail chub was very rare with few documented records in the mainstem Colorado River between the two basins (Minckley 1973, p. 102; Minckley 1979, p. 51; Valdez and Ryel 1994, pp. 5-10–5-11; Minckley 1996, p. 75; Bezzerides and Bestgen 2002, pp. 24–25; Voeltz 2002, pp. 19, 112), so we do not consider the mainstem to have been occupied historically, and have not considered the Colorado River in our estimates of historical range. The information on historical distribution is clouded because early surveyors also variably used the term "bonytail" to describe roundtail chub (Valdez and Ryel 1994, pp. 5–7). The bonytail chub (*Gila elegans*) is a species in the mainstem Colorado River. Some historical accounts of roundtail chub in the mainstem may have, in fact, been bonytail chub. Records of roundtail chub from the mainstem Colorado River also may have been transients from nearby populations, such as some records from Grand Canyon, which may have been from the Little Colorado River (Voeltz 2002, p. 112). One record from between the two basins, a record of two roundtail chubs captured near Imperial Dam in 1973, illustrates this. Upon examining these specimens, Minckley (1979, p. 51) concluded that they were strays washed downstream from the Bill Williams River based on their heavily blotched coloration. This is a logical conclusion considering that roundtail chub from the Bill Williams River typically exhibit this blotched coloration (Rinne 1969, pp. 20–21; Rinne 1976, p. 78). Minckley (1979, p. 51), Minckley (1996, p. 75), and Mueller and Marsh (2002, p. 40) also considered roundtail chub rare or essentially absent in the Colorado River mainstem based on the paucity of records from numerous surveys of the Colorado River mainstem.

We conclude that, historically, roundtail chub occurred in the Colorado River basin in two population centers, one each in the upper (largely in Utah and Colorado, and to a lesser extent, in Wyoming and New Mexico) and lower basins (Arizona and New Mexico), with

apparently little, if any, mixing of the two populations. If there was one population, we would expect to find a large number of records in the mainstem Colorado River between the San Juan and Bill Williams Rivers, but very few records of roundtail chub exist from this reach of stream. Also, there is a substantial distance between these areas of roundtail chub occurrence in the two basins. The mouth of the Escalante River, which contains the southernmost population of roundtail chub in the upper basin, is approximately 443 kilometers (km) (275 river miles (mi)) upstream from Grand Falls on the Little Colorado River, the historical downstream limit of the most northern population of the lower Colorado River basin. The lower Colorado River basin roundtail chub population segment meets the element of discreteness because it was separate historically, and continues to be markedly separate today.

Additionally, in more recent times, the upper and lower basin populations of the roundtail chub have been physically separated by Glen Canyon Dam. That artificial separation is not the sole basis for our finding that the lower basin population is discrete from the upper basin population. The historical information on collections suggests that there was limited contact even before the dam was built. Available molecular information for the species, although sparse, seems to support this as genetic markers from roundtail chub in the Gila River basin are entirely absent from upper basin populations (Gerber et al. 2001, p. 2028; see *Significance* discussion, below).

Accordingly, we reaffirm our finding that the lower Colorado River basin population segment of roundtail chub is discrete from other populations of the species.

Significance

Since we have determined that the roundtail chub in the lower Colorado River basin meet the discreteness element of the DPS Policy, we now consider the population segment's biological and ecological significance based on "the available scientific evidence of the discrete population segment's importance to the taxon to which it belongs" in light of congressional guidance that the authority to list DPSs be used "sparingly" while encouraging the conservation of genetic diversity (DPS Policy, 61 FR 4722; S. Rep. No. 96–151 (1979)).

The DPS Policy describes four classes of information, or considerations, to take into account in evaluating a population segment's biological and ecological importance to the taxon to which it belongs. As precise circumstances are likely to vary considerably from case to case, the DPS policy does not state that these are the only classes of information that might factor into a determination of the biological and ecological importance of a discrete population. As specified in the DPS policy (61 FR 4722), consideration of the population segment's significance may include, but is not limited to, the following classes of information: (1) Persistence of the discrete population segment in an ecological setting that is unusual or unique for the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; or (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. Significance of the discrete population segment is not necessarily determined by existence of one of these

classes of information standing alone. Rather, information analyzed under these considerations is evaluated relative to the biological or ecological importance of the discrete population to the taxon as a whole. Accordingly, all relevant and available biological and ecological information is analyzed for importance to the taxon as a whole. Below, we provide our analysis of the significance of the lower Colorado River basin roundtail chub populations.

Persistence of the Population Segment in an Unusual or Unique Ecological Setting

Based on our review of the best available information, we found that there are some differences in various ecoregion variables between the upper and lower Colorado River basins. For example, McNabb and Avers (1994) and Bailey (1995) delineated ecoregions and sections of the United States based on a combination of climate, vegetation, geology, and other factors. Populations of roundtail chub in the lower basin and in the upper basin occur primarily in different ecoregions. These ecoregions display differences in the natural hydrograph in the type, timing, and amount of precipitation between the two basins, with the upper basin (8-165 cm (3–65 in) per year) (Jeppson 1968, p. 1) somewhat less arid than the lower basin (13-64 cm (5–25 in) per year) (Green and Sellers 1964, pp. 8–11).

The primary difference is that, in the lower basin there are two seasonal peaks of streamflow, a monsoon hydrograph plus the spring runoff season. In the upper basin, roundtail chub habitats have strong snowmelt hydrographs, with some summer, fall, and winter precipitation, but with the majority of major flow events in spring and early summer (Bailey 1995, p. 341; Carlson and Muth 1989, p. 222; Woodhouse et al. 2003, p. 1551). The biology of

the roundtail chub indicates the importance of the spring runoff as the cue for spawning, and this cue operates in both the upper and lower basins (Bezzerides and Bestgen 2002, p. 21). The variability of the monsoon storms to provide for higher flows later in the summer is such that it does not have an influence on successful spawning. While there are differences in the ecological settings between the two segments, these differences are not likely to be significant to the taxon.

Significant Gap in the Range of the Taxon

Roundtail chub in the lower Colorado River basin can be considered significant under our DPS Policy because loss of the lower Colorado River populations of roundtail chub would result in a significant gap in the range of the taxon. The lower and upper Colorado River basins are approximately 443 km (275 river mi) and possess a unique, divergent mtDNA lineage that has never been found outside the lower basin (Dowling and DeMarais 1993, pp. 444– 446; Gerber et al. 2001, p. 2028). The lower Colorado River area constitutes over one third of the species' historical range. There are 74 populations of roundtail chub remaining in the upper basin and 31 in the lower basin. Thus, the lower basin populations constitute approximately one third (30 percent) of the remaining populations of the species (Bezzerides and Bestgen 2002, pp. 28–29, Appendix C; Voeltz 2002, pp. 82–83). The populations in the lower basin account for approximately 49 percent (107,300 square mi, 270,906 square km) of the Colorado River Basin (U.S. Geological Survey 2006, pp. 94–102). In addition, the roundtail chub historically occupied up to 2,796 mi (4,500 km) of stream in the lower basin and currently occupies between 497 mi (800 km) and 901 mi (1450 km) of stream habitat in the lower basin. These populations are not newly established, ephemeral, or migratory. The species has been well established in the lower

Colorado River basin, and has represented a large portion of the species' range for a long period of time (Bezzerides and Bestgen 2002, pp. 20–29; Voeltz 2002, pp. 82– 83). The loss of one third of a unique, divergent mtDNA lineage that has never been found outside the lower basin (Dowling and DeMarais 1993, pp. 444– 446; Gerber et al. 2001, p. 2028) of the species as a whole would constitute a significant gap in the range.

Natural Occurrence of a Taxon Elsewhere as an Introduced Population

As part of a determination of significance, our DPS Policy suggests that we consider whether there is evidence that the population represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range (61 FR 4725). The roundtail chub in the lower Colorado River basin is not the only surviving natural occurrence of the species. Consequently, this factor is not applicable to our determination regarding significance.

Marked Differences in Genetic Characteristics

As stated in the DPS Policy, in assessing the significance of a discrete population, the Service considers evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics (61 FR 4725). There have been long-standing difficulties in morphological discrimination and taxonomic distinction among members from the lower Colorado *Gila robusta* complex, and the genus Gila as a whole, due in part to the role hybridization has played in its evolution. But it is important to consider variation

throughout the entire Colorado River basin to place variation and divergence in the lower basin *Gila robusta* complex in appropriate context.

Along with *G. robusta*, *G. cypha* and *G. elegans* are present in the mainstem Colorado River and many large tributaries throughout the basin. Lower Colorado River basin populations of these three species exhibited distinct mtDNAs, with only limited introgression of *G. elegans* into *G. cypha* (Gerber et al. 2001, p. 2028). *G. robusta* individuals from the headwaters of the Little Colorado River and the mainstem Colorado River and tributaries above Glen Canyon Dam in the upper basin possess *G. cypha* or *G. elegans* mtDNA (Dowling and DeMarais 1993, pp. 444–446; Gerber et al. 2001, p. 2028). Populations of the *G. robusta* complex of the lower basin in the Bill Williams and Gila River basins (including *G. robusta, G. intermedia,* and *G. nigra*) possess a unique, divergent mtDNA lineage that has never been found outside the lower basin (Dowling and DeMarais 1993, pp. 444– 446; Gerber et al. 2001, p. 2028). Conversely, in the upper Colorado River basin populations, the impact of hybridization was significant. Most upper basin fish sampled exhibited only *G. cypha* mtDNA haplotypes, with some individuals exhibiting mtDNA from *G. elegans* (Gerber et al. 2001, p. 2028). The complete absence of *G. robusta* mtDNA, even in populations of morphologically pure *G. robusta,* indicates extensive introgression that predates human influence.

Gerber et al. (2001, p. 2037) noted that genetic information in *Gila* poorly accounts for species morphology, stating that "the decoupling of morphological and mtDNA variation in Colorado River Gila illustrates how hybridization and local adaptation can play important roles in evolution." The lower Colorado River discrete population segment differs markedly from the

upper Colorado River basin segment due to the unique, divergent genetic lineage of the lower basin.

Summary of Significance

The divergent genetic lineage within the lower Colorado River basin (Dowling and DeMarais 1993, pp. 444– 446; Gerber et al. 2001, p. 2028) demonstrates a marked difference in genetic characteristics from the upper Colorado River basin segment. In addition, the lower Colorado River basin segment constitutes one third of the species' range; the loss of which would result in a significant gap in the species' range. The lower Colorado River basin population of roundtail chub is therefore significant to the species as whole because the loss of this population would create a significant gap in the range and the population demonstrates a marked difference in genetic characteristics.

DPS Conclusion

We have evaluated the lower Colorado River population segment of the roundtail chub to determine whether it meet the definition of a DPS, addressing discreteness and significance as required by our policy. On the basis of the best available information, we conclude that the lower Colorado River populations are discrete from the upper Colorado River basin populations on the basis of their present and historical geographic separation of 275 river mi (444 km) and because few historical records have been detected in the mainstem Colorado River between the two population centers that would suggest meaningful connectivity. We also conclude that the

lower Colorado River basin roundtail chub is significant because of its unique genetic lineage, which differs markedly from the upper basin, and that the loss of the species from the lower basin would result in a significant gap in the range of the species. Because this population segment meets both the discreteness and significance elements of our DPS policy, the lower Colorado River population segment of the roundtail chub qualifies as a DPS in accordance with our DPS policy, and, as such, is a listable entity under the Act.

Summary of Biological Status and Threats

The Act directs us to determine whether any species is an endangered species or a threatened species based on any on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We completed the Draft Headwater Chub and Lower Colorado River DPS of Roundtail Chub Species Status Assessment (SSA Report) (Service 2015; entire), which is available online at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2015–0148. The SSA Report documents the results of the comprehensive biological status review for the headwater chub and lower Colorado River basin roundtail chub DPS, which provides a thorough account of the species' overall viability. We define viability here as a description of the ability of the species to sustain populations in the wild beyond a biologically meaningful timeframe. For these species, we assessed the future viability about 30 years from the present or around 2046. In the SSA Report, we assess the viability of the headwater chub and the lower Colorado

River basin roundtail chub DPS in terms of resiliency, redundancy, and representation. Resiliency is having sufficiently large populations for the species to withstand stochastic events. Redundancy is having a sufficient number of populations for the species to withstand catastrophic events. Representation is having the breadth of genetic makeup of the species to adapt to changing environmental conditions.

In the SSA Report, we summarize the relevant biological data and a description of past, present, and likely future risk factors (causes and effects) and provide an analysis of the viability of the species. Specifically, we evaluate the risk of extirpation of individual analysis units (AUs). The SSA Report provides the scientific basis that informs our regulatory decision regarding whether these species should be listed as 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 analysis on which this determination is based, and the following discussion is a summary of the results and conclusions from the SSA Report.

Historical and Current Range and Distribution

The occurrence records of both species show some inconsistencies and in some cases use incorrect common names. Therefore, we used the best available information and made some decisions on assignment of chub species that may not be consistent with museum records, but we based these decisions on more current information and biological characters.

Assignment of chubs in a stream to headwater, roundtail, or Gila is difficult due to the morphological and genetic similarities. Typically, assignment to species is based on the geographical location. Assignment to one or the other species has been made for all populations or streams of the headwater chub and roundtail chub DPS. However, there is some uncertainty within three streams (Fossil Creek and West Clear Creek in the Verde River drainage, and Turkey Creek in the Upper Gila drainage) where the species overlap, and likely hybridize with one another. Each of these locations is discussed in more detail below. For the purposes of the SSA Report and the SSA Model, we will evaluate Fossil Creek as having headwater chub from the constructed barrier upstream to Fossil Springs (above the barrier) and roundtail chub from the mouth of Fossil Creek to Irving (below the barrier), with a mix between Irving and the fish barrier. In West Clear Creek, for the SSA Report, we will consider lower and upper West Clear Creek are roundtail chub based on our past assignment. In Turkey Creek for the SSA Report, we will consider Turkey Creek contains only Gila chub, but not headwater chub.

In the SSA Report, we use AUs to describe the populations of chubs. The AUs were delineated based on the hydrological connectivity of currently occupied streams and the ability of chubs to move within or among streams. There are two types of AUs considered in the SSA Report: (1) Those composed of one occupied stream, referred to as independent AUs; and (2) those composed of two or more hydrologically connected occupied streams, referred to as complex AUs.

Headwater Chub

Based on our assessment, headwater chub historically occupied 26 streams with a maximum total stream length of 892 kilometers (km) (554 miles (mi)). The streams were distributed over three drainage basins: Gila River, Salt River, and Verde River. As of 2015, headwater chub are found in 22 streams with a collective minimum of 432 km (268 mi) of available habitat: 406 km (252 mi) from the historically occupied streams and 26 km (16 mi) from occupied streams newly discovered. We evaluated the reduction in range based on stream length rather than the number of streams because this provides a more accurate assessment of the amount of habitat. Listing the number of streams does not provide an account of the available habitat because streams could vary greatly in length. This represents at least 48 percent of the estimated historical range and no more than a 52 percent reduction in range. We document the extirpation of chubs from four historically occupied streams, totaling 71 km (44 mi). Additionally, we know that chub are not found in portions of Haiger and Tonto Creeks (approximately 25 km (16 mi) and 18 km (11 mi), respectively), where they were historically. This accounts for 114 km of the reduction in range, leaving 346 km (71 mi) unaccounted for. This 346 km (71 mi) may represent actual habitat lost or may be due to differences in the methodologies used in calculating the historical and current ranges, or a combination of both.

Table 1. Estimated Historical and Current Ranges (in linear stream km) of the Headwater Chub in the Lower Colorado River Basin for the SSA Report.

Species of chub	Estimated historical range based on stream length(km)[1]	Estimated current range (km & % of estimated historical range currently	Estimated reduction in range (km & % of estimated historical range that no longer	Number of streams historically occupied	Number of streams currently occupied

		occupied)[2]	contains chubs)		
Headwater	892	432 (48%)	460 (52%)	26	22

[1] This includes perennial, intermittent, and dry reaches within a stream.

[2] This includes perennial and interrupted perennial reaches within a stream.

Lower Colorado River Basin Roundtail Chub DPS

The lower Colorado River basin roundtail chub DPS historically occupied 48 streams with a maximum total stream length of 4,914 km (3,053 mi). The streams were distributed across five drainage basins: Bill Williams River, Gila River, Little Colorado River, Salt River, and Verde River. As of 2015, roundtail chub are found in 35 streams with a collective minimum of 2,098 km (1,303 mi) of available habitat: 2,077 km (1,291 mi) from the historically occupied streams and 21 km (13 mi) from occupied streams newly discovered. We evaluated the reduction in range based on stream length rather than the number of streams because this provides a more accurate assessment of the amount of habitat. Listing the number of streams does not provide an account of the available habitat because streams could vary greatly in length. This represents at least 43 percent of the historical range and no more than a 57 percent reduction in range. We document the extirpation of chubs from six historically occupied streams, totaling 1,864 km (1,158 mi). Therefore, approximately 234 km (145 mi) of the potential reduction in range is unaccounted for. This 234 km (145 mi) may represent actual habitat lost or may be due to differences in the methodologies used in calculating the historical and current ranges, or a combination of both.

There are also four newly established populations for the lower Colorado River basin roundtail chub DPS: Blue River in the Gila River drainage basin, Ash Creek in the Salt River drainage basin, and Gap Creek and Roundtree Creek in the Verde River drainage basin. Blue River is 81 km (50 mi) watered length, Ash Creek is about 5 km (3 mi) watered length, Gap Creek and Roundtree Canyon Creek are about 3 km (2 mi) in watered length each. The total wetted length of all four streams is 92 km (57 mi).

Historically, populations in the lower Colorado River basin roundtail chub DPS had greater connectivity to each other. However, roundtail chub are extirpated from several large riverine streams that provided connectivity across most of the historically occupied range. This has resulted in the recent isolation of AUs even within the same drainage basin.

Table 2. Estimated Historical and Current Ranges (in linear stream km) of the Roundtail Chub in the Lower Colorado River Basin for the SSA Report.

Species of chub	Estimated historical range based on stream length(km)[1]	Estimated current range (km & % of estimated historical range currently occupied)[2]	Estimated reduction in range (km & % of estimated historical range that no longer contains chubs)	Number of streams historically occupied	Number of streams currently occupied
Roundtail	4,914	2,098 (43%)	2,816 (57%)	48	35

[1] This includes perennial, intermittent, and dry reaches within a stream.

[2] This includes perennial and interrupted perennial reaches within a stream.

Individual, Population, and Species Needs for Headwater Chub and the Lower Colorado River Basin Roundtail Chub DPS

Both adult headwater chub and the lower Colorado River basin roundtail chub DPS need slow-moving, deep pools, and juveniles and young-of-the-year need shallow water along stream banks. For shelter, they need large rocks, undercut banks, and woody debris. For spawning, they need pool, run, and riffle habitats with sandy-rocky substrates and slow to moderate water velocities. For feeding, adults need plants, detritus, and arthropods (aquatic and terrestrial), and juveniles and young-of-the-year need diatoms, filamentous algae, and insects. Adults may also consume small fish, as they are the top native fish predator in their habitat (Pilger et al. 2010, p. 306).

Both headwater chub and the lower Colorado River basin roundtail chub DPS need to have multiple resilient populations distributed throughout different drainage basins within their historical range to maintain viability into the future and avoid extinction. Resilient chub populations must be of sufficient size to withstand stochastic events such as demographic effects of low genetic diversity and environmental variability. The best available data do not indicate a minimum or preferred population size. However, large (or more resilient) populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), or variations in rainfall (environmental stochasticity). The resiliency of headwater chub or the lower Colorado River basin roundtail chub DPS populations is largely governed by: (1) The quantity, distribution, and connectivity of habitat; (2) the quality of habitat (specifically deep pools for adults and shallow waters along stream banks for juveniles and young-of-the-

year); and (3) the presence or absence of nonnative aquatic species. These conditions combine to control the size of the chub population and its age structure (which increases the resiliency of AUs in terms of demographic stochasticity and genetic diversity). Further, these conditions control the extent of habitat available to serve as refuge sites for chub to survive environmental stochasticity and localized threats from land and water uses, and allow re-occupancy of the affected habitat area after the event.

For redundancy, both the species and DPS need a sufficient number of resilient populations to withstand catastrophic events. The wider the distribution of resilient populations and the greater the number of populations, the more redundancy the species or DPS will have. This redundancy reduces the risk that a large portion of the range will be negatively affected by any catastrophic event at any one time. Species that are well distributed across their historical range (i.e., having high redundancy) are less susceptible to extinction and more likely to be viable than species confined to a small portion of their range (Carroll *et al*. 2012, entire; Redford *et al*. 2011, entire).

Having a breadth of genetic makeup of the species to adapt to changing environmental conditions is needed for representation. Representation can be measured through the genetic diversity within and among populations, and the ecological diversity (variety of ways species interact with each other and the environment) of populations across the species' range. The more representation, or diversity, the species has, the more it may be capable of adapting to changes (natural or human caused) in its environment. In the case of the headwater chub and lower

Colorado River basin roundtail chub DPS, maintenance of the identified genetic diversity in AUs across the species' and DPS's geographic range is important.

Risk Factors for Headwater Chub and the Lower Colorado River Basin Roundtail Chub DPS

We reviewed the potential factors that may affect the headwater chub and lower Colorado River basin roundtail chub. We found three primary risk categories: (1) Competition with, predation from, and harassment by nonnative aquatic species; (2) a lack of sufficient water to support the physical and biological components needed for all life stages and life-history functions; and (3) changes in the timing and amount of snowmelt runoff in the spring and precipitation from monsoons in the fall, reduction in hydrologic connectivity within and between streams, and the reduction in the length of flowing reaches (all of which are impacts from climate change). All three of these risks categories likely have population-level effects to both the headwater chub and the lower Colorado River basin roundtail chub DPS.

We considered several other potential risk factors that may have population-level effects to either the headwater chub or the lower Colorado River basin roundtail chub DPS, but we were not able to incorporate into the model. These include wildfire risk, additional climate change impacts (other than those considered in the model), water loss due to anthropogenic actions, and demographic impacts from these factors and the reduction in the range. We evaluated impacts from these additional risks to each AU and the species/DPS as a whole.

There are other risks to both chub species that can result in localized effects, including grazing, roads, forestry practices, disease, pathogens, and recreation. While these may have effects on individual chubs, they are not likely to have population-level impacts on either the headwater chub or the lower Colorado River basin roundtail chub DPS, as explained in chapter 7 and appendix B of the SSA Report.

Across the historical range, the quality and quantity of habitat, abundance of headwater chub and roundtail chub, and condition of the AUs has been altered. The introduction of nonnative aquatic species and changes in water flows, caused by human activities (either surface water diversion or groundwater pumping) and climate change, leading to a reduction in water availability, have led to reductions in chub abundance and habitat quality and quantity. Nonnative aquatic species occur within almost all streams occupied by these two chub species. The changes in flows have altered the connectivity and spatial distribution of chubs, resulting in segmentation of watered areas within individual streams and loss of connectivity between streams.

Nonnative fish are the most significant risk factor to the lower Colorado River fish fauna, including headwater chub and the lower Colorado River roundtail chub DPS, due to competition and predation (Minckley and Deacon 1991; Carlson and Muth 1989, p. 220; Mueller 2005, pp. 10–12; Olden and Poff 2005, p. 75). It has now been shown that contamination by nonnative fishes is the most significant risk factor to the lower Colorado River fish fauna due to competition and predation (Minckley and Deacon 1991; Carlson and Muth 1989, p. 220; Mueller 2005, pp. 10–12; Olden and Poff 2005, p. 75), and nonnative aquatic species are the primary

impediment to the native fish species' success (Minckley and Marsh 2009, p. 51). Declines in native fish, including roundtail and headwater chubs, are largely attributable to predation, with early life stages (Minckley 1983, p. 182) being the most vulnerable. Clarkson *et al*. (2005, p. 20) noted that over 50 nonnative aquatic species were introduced into the Southwest as either sport fish or baitfish. Lower West Clear Creek showed a reduction in roundtail chub after smallmouth bass became a significant part of the fish community (Brouder et al. 2000, pp. 9, 13; Jones et al. 2014, pp. 70-71), and in the upper Salt River after flathead catfish were introduced (AGFD 1996), and these reductions have been interpreted as resulting from those nonnative fish expansions. Fathead minnow (*Pimephales promelas*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinella lutrensis*), western mosquitofish (*Gambusia affinis*), largemouth bass (Micropterus salmoides), flathead catfish (*Pylodictis olivaris*) (Fuller 1999, p. 208), and channel catfish (*Ictalurus punctatus*) are among the fastest expanding nonnative fishes in the basin and are considered to be the most invasive in terms of their negative impacts on native fish communities (Olden and Poff 2005, pp. 83-84). Of these species, green sunfish, flathead catfish, smallmouth bass, and largemouth bass are considered to impact chubs the most.

However, there are streams where chubs have maintained populations in the presence of one or more of these nonnative aquatic species, but the mechanisms providing for that coexistence in any particular stream are unknown. The nonnative aquatic species community varies for different streams. The amount of preferred habitat available for both the chub and the nonnative aquatic species may play a role, as may the abundance of the nonnative species and its means of affecting the chub. In some cases, the nonnative aquatic species may have only newly entered the stream and the full effects have not been realized. In other cases, the current habitat

and population dynamics may not strongly favor either natives or nonnatives, allowing for persistence of both under those conditions. While chubs coexist with nonnative aquatic species in several streams, this does not mean that nonnative aquatic species are not impacting chubs or that nonnative aquatic species are not having population-level impacts on chubs. Marks et al. (2009, pp. 15, 21) looked at the response of native fish in Fossil Creek before and after nonnative fish were removed from the stream. With the removal of these nonnative fish, headwater and roundtail chub numbers increased 70 times over the pre-removal numbers due to the success of spawning and survival of young-of-the-year chubs.

Nonnative aquatic species occur within all streams occupied by chubs with the exception of three streams for each species. We expect that nonnative aquatic species will continue to persist in most, if not all, of the streams they currently occupy because they have readily adapted to the stream conditions and removing them from areas they currently occupy is difficult and expensive. Further, it is likely that the increase in the frequency and severity of droughts, the reduction of flowing regions within a network of streams, and an increase in the length of dry patches within a stream as a result of climate change will exacerbate the impacts from nonnative aquatic species. This is because as the available watered segments decrease, the interactions between nonnatives and chubs increase, with more larvae and young-of-the-year removed from the chub populations due to predation by nonnative aquatic species. In addition, resources become more limited and the competition for these resources increases, resulting in decreased food for chubs and more competition for that food. The reduction in water will likely decrease the water quality (e.g., decreased dissolved oxygen, temperature increases, changes in pH, and nutrient loading) (Lake 2000, p.578; Lake 2003, p. 1165), which nonnative aquatic species are

likely more capable of adapting to than the chubs .(Eaton and Scheller 1996, p. 1111; Rahel and Olden 2008, p. 527; Rahel et al. 2008, pp. 554-555). While the chubs have maintained a presence in several streams with nonnatives, the impacts from nonnative aquatic species exacerbated by other factors reduce the streams' ability to withstand stochastic events. In addition, there is the potential that the six streams (three for headwater chub and three for lower Colorado River basin roundtail chub DPS) that currently do not have nonnative aquatic species could be infiltrated by nonnatives. The three headwater chub streams are Diamond Creek in the Gila River basin, and Buzzard Roost Creek and Turkey Creek in the Tonto Creek basin. For the lower Colorado River basin roundtail chub DPS, the streams are Stone Corral Canyon Creek and Conger Creek in the Bill Williams basin, and Canyon Creek in the Salt River basin.

Nonnative aquatic species could be introduced through the release of baitfish, intentional introduction by anglers for sport fishing, or flooding events, which allow chubs to pass low water barriers. The management of nonnatives is an important tool in the conservation of these species. Currently, due to a lack of a producer for Antimycin A and lack of Environmental Protection Agency (EPA) registration for other potential piscicides in development, the most effective method to remove fish is rotenone. However, the process for public coordination and other steps required on the pesticide label make it difficult and time-consuming to use rotenone under Federal law, and even more so under Arizona State Law (ARS Title 17-481) and Arizona Game and Fish Commission policy. Given vocal public and political opposition to rotenone treatments, stream restoration has become difficult in Arizona because of the lengthy bureaucratic process attached to those treatments. Without this tool, management of nonnative aquatic species will become more difficult (Pool et al. 2013, p. 640).

Water is the basic habitat component needed for both chub species' survival and to support the various life stages and life-history functions. Water supports the needed physical and biological characteristics in streams to provide suitable chub habitat. There is a strong seasonal component to the amount of water available in a stream. There is snowmelt in the spring, which is important for spawning, and monsoon rains in the summer that is important during the driest time of year (late spring, early summer). Spatial and temporal variation in water amount and temperature may influence timing and periodicity of spawning, influence elevation distributions within stream systems, and impact the life cycles and availability of food resources (Dallas 2008, pp. 395-397). Historically, the amount of water in any stream at any time was determined by natural water sources, such as surface flow, springs, and alluvial groundwater input. Currently, these natural water sources are impacted by climate change (discussed below) and human actions. The creation of large water storage dams (such as those on the Salt and Verde Rivers) eliminate flowing sections of water and replace them with large reservoirs that support nonnative fish species. Chubs may be found in these large reservoirs initially, but do not persist there (Bezzerides and Bestgen 2002, p. 18). The dams that form the reservoirs are impassible obstacles and prevent chubs from moving through the system, resulting in occupied fragments of a stream where there was once full connectivity.

On the smaller scale, diversion dams that allow for removal of water from the stream for human uses may or may not be barriers to connectivity depending on their size and structure; however, their effect on flows can be substantial depending on the number of diversions in a stream, and the season of diversion. For agriculture, the primary diversion season is in the late

spring through early fall. Generally, late spring and early summer is the time of year with the lowest flow and when water supplies are already stressed. This contributes to local stream drying, where the reach below the diversion can be all or partially dry until any return flows from the land use from agricultural fields, groundwater levels restore surface flow, or monsoon rains. In addition to direct removal of surface flow, wells that tap the alluvial groundwater (the shallow aquifer that also supports the surface flow in a stream) can reduce the level of the groundwater such that it is below the streambed elevation and cannot provide surface flows. In areas with few wells, this is generally not a significant concern; however, in areas with denser human development (as is found along the East Verde River, Oak Creek, and Wet Beaver Creek), stream drying occurs occurs (Girmendonk and Young 1997, pp. 31-32, 42; Paradzick et al 2006, pp.9-12). Demand for water is projected to increase as human populations are predicted to increase, affecting the timing, amount, and distribution of water within streams.

Climate change models project alteration in the timing and amount of snowmelt and monsoon rains, and the frequency and duration of droughts, as well as increases in temperature resulting in increased evaporation. During the spring and early monsoon seasons, the flowing regions of the Verde River stream network (areas with water) are projected to diminish a median of 8 percent and a maximum of 20 percent (Jaeger et al. 2014, p. 3) from their current status in the Verde River basin. Over much of the western United States and western Canada, warmer winters are projected to produce earlier runoff and discharge but less snow water equivalent and shortened snowmelt seasons in many snow-dominated areas (Barnett et al. 2005, entire; Rood et al. 2008, entire; Reba et al. 2011, entire).

Climate change model predictions suggest that climate change will shrink the length of the remaining flowing reaches in the Verde River, in the lower Colorado River basin, where both these species occur (Jaeger et al. 2014, p. 3). The frequency of stream drying events in the Verde Valley is expected to increase by approximately 17 percent (Jaeger et al. 2014, p. 13895), due in large part to groundwater decline. These regions that support flow are increasingly isolated as adjacent dry fragments expand in length and occur more frequently across these seasons. Model predictions suggest that midcentury and late-century climate will reduce network-wide hydrological connectivity. Midcentury and late-century climate model projections suggest that more frequent and severe droughts will reduce network-wide hydrologic connectivity for native fishes by 6 to 9 percent over the course of a year and up to 12 to 18 percent during spring spawning months (Jaeger et al. 2014, p. 3). The reduction in the length of the remaining flowing reaches will further increase native and nonnative aquatic species interactions and resource limitations, and will compromise the ability of these habitats to support native fishes (Jaeger et al. 2014, p. 3), including these chub species.

The best available data indicate that climate change and increased human population levels in the Verde Valley in the lower Colorado River basin will result in lowered groundwater levels and stream base flows to some degree (Garner et al. 2013, p. 23; Jaeger et al. 2014, p. 13895). The decline in groundwater levels and base flows in the region is expected to be caused by increased groundwater pumping, by surface water diversion, and from an increase in the frequency and severity of droughts in Arizona as a result of climate change. Specifically, future water levels and stream base flows are expected to continue decreasing along the Verde River and Oak Creek in response to increased pumping, particularly over the next 50 years (Owens-

Joyce and Bell 1983, pp. 1, 65; McGavock 1996, p. 67; Blasch et al. 2006, p. 2; Garner et al. 2013). The best available information regarding future water availability for chubs includes models of the groundwater and base flow in the Verde River through approximately 2050. These models indicate a maximum of 20 percent loss of flow for the Verde River by approximately 2050 during dry times of the year (Jaeger et al. 2014, p. 13897). Despite native fishes having evolved life-history strategies to cope with the harsh environmental conditions that occur as a result of stream drying events, the predicted spatiotemporal changes in streamflow likely will have adverse consequences for the distribution, abundance, and persistence of these species into the future.

Effects to chubs from wildfire vary depending on the wildfire and streams. The severity, location, and timing of the wildfire influence the impact of wildfire to chubs depending on the amount of runoff, and degree of sediment and ash in the runoff. The size and condition of the stream also influences the impact to chubs from wildfire. There are streams where chubs (and other fish species) survived the post-fire ash/sediment flows following wildfire. This happened in the Upper Gila, Black River, and Spring Creek (Tonto River drainage). It is probable that there were individual fish that died or were harmed, and population numbers (or health) were reduced. However, populations that were initially depressed in these streams have rebounded, even increasing in abundance or extent relative to pre-fire conditions. However, in certain streams, like Cave Creek, Gila chub populations were impacted by the Cave Creek Complex Fire through changes in habitat abundance, in which pools where filled with sediment. However, Gila chub still persist in all the locations that were occupied by chub prior to the Cave Creek Complex Fire. Forest management at large landscape scales across the ranges of the chubs is

occurring and will continue to occur to reduce forest fuels and therefore reduce wildfire risk and severity. However, the effects from climate change, such as increased temperatures, increased evaporation, and change in timing and amount of precipitation, are likely to create conditions more favorable to wildfire. Wildfire can result in impacts to individuals and could also result in population-level impacts. Wildfire could impact any stream or any AU within the range of both species. Severe or extensive wildfires that occur in smaller AUs and independent AUs are more likely to have an impact on these species as a whole. However, we are unable to predict when or where such fires could occur, nor the impacts to chubs from these wildfires, but we recognize that wildfires are highly likely to occur. We further recognize that not all fire is harmful to these species.

As a result of the risk factors described above, particularly from climate change, the connectivity of chubs within and between streams is impacted, resulting in fragmented streams and AUs that could have population-level impacts to chubs. This results in small and isolated populations, susceptible to demographic impacts. Demographic impacts include loss of genetic diversity from inbreeding depression and genetic drift resulting in young that may have reduced fitness to cope with existing or changing conditions. This decreases a population's ability to adapt to environmental changes and increases vulnerability to extirpation (i.e., decreases resiliency). Fagan *et al*. (2002, p. 3254) found that, as a result of fragmentation and isolation, roundtail chub has a moderately high risk of local extirpation (0.41 percent probability) because recolonization from adjacent populations is less likely. Headwater chub, which has naturally fragmented populations, has a lower risk of local extirpation (0.28 percent probability), as it still occupies many of its historical localities, which are headwater and smaller tributary habitats.

However, fragmentation within those populations exercises the same potential for adverse effects of small, isolated populations. In examining the relationship between species distribution and extinction risk in southwestern fishes, Fagan *et al*. (2002, p. 3250) found that the number of occurrences or populations of a species is less significant a factor in determining extinction risk than is habitat fragmentation.

These species developed as a result of multiple independent hybridization events over time (Rinne 1976; Rosenfeld and Wilkinson 1989; DeMarais et al. 1992; Dowling and DeMarais 1993; Minckley and DeMarais 2000; Gerber et al. 2001; Schwemm 2006; Schönhuth et al. 2014). Historically roundtail chub had greater connectivity among populations and subsequent relatedness over the region. The development of populations in isolation from other roundtail chub was not the normal condition across most of the historical range except in the Bill Williams River and Little Colorado River drainages. In the lower Colorado River basin roundtail chub DPS, genetic variation occurs mainly within populations. For roundtail chub, demographic effects could result not only if AUs are fragmented but also if connectivity among AUs is fragmented.

In headwater chub, most of their genetic variation occurs among populations, each of which tends to be distinctive. Each AU is geographically isolated from the other AUs even in the same drainage basin. For headwater chub, demographic effects could result if AUs become fragmented due the unique genetic variation within each AU. As the demand for water by humans and the effects of climate change increase, water is likely to become more limited. This loss of water affects the water flow in a stream and the number and length of watered and dry

stream segments (i.e., increased fragmentation of a stream). As fragmentation increases so does the risk of demographic impacts. Small and isolated populations are vulnerable to loss of genetic diversity, which decreases a population's ability to adapt to environmental changes and increases vulnerability to extirpation.

Conservation Efforts for Headwater Chub and the Lower Colorado River Basin Roundtail Chub DPS

Past conservation efforts include the establishment of new populations for roundtail chub in the lower Colorado River Basin DPS and the renovation or securing of currently occupied areas for headwater and roundtail chub in the lower Colorado River Basin DPS. Newly established populations are sites where chubs have been released within the species' historical range. This involves locating a site with suitable habitat, free of nonnative aquatic species or with nonnatives to be removed, through chemical or mechanical means. Establishment of a hatchery broodstock for the streams at risk of loss of wild populations provides for newly established populations to those areas. Renovation or securing of a population involves salvaging the chub species from the stream, then the removal of nonnative aquatic species and potentially the installation of a barrier to keep nonnatives out of the site, and then the release of salvaged chubs back into the stream. Stream renovation is labor- and time-intensive. The salvage of chubs takes significant resources in terms of time, personnel, and funding. Temporary housing for the salvaged chub is needed while the nonnative aquatic species are removed. The eradication of nonnative aquatic species from streams is essential for establishing new populations or securing populations. However, removing nonnative aquatic species from a

stream is difficult and typically requires multiple efforts. Rotenone is the most effective means of eradicating nonnatives from a stream. If there is not a barrier to prevent nonnative aquatic species from moving into the renovated area, then a barrier will need to be constructed prior to removing the nonnatives. Once the nonnative aquatic species are removed and a barrier put in place, chubs are released back into the stream. It is likely that not all nonnative aquatic species were removed, and a rotenone treatment will be necessary at some point in the future. This will require salvaging the chubs again and applying the rotenone, and then releasing the salvage chubs.

Removal of nonnative aquatic species has been used as a securing action for Fossil Creek for both headwater and roundtail chub. This effort has been successful, but significant time and resources were expended to secure the site and continue to be needed to maintain this site. Consequently, due to the expense and time, there is uncertainty regarding the securing of sites in the future.

There are currently four newly established sites for the roundtail chub in the lower Colorado River basin. The four new established populations are: Blue River, Ash Creek, Gap Creek, and Roundtree Creek. Blue River is the only established site with documented reproduction. This site has a high potential for success; however, it is a relatively new site established in 2012. The other three sites have not shown reproduction. Their long-term viability is uncertain.

Three of the established sites are free of nonnative aquatic species. Blue Creek, the fourth newly established site, does contain some nonnatives but the community level of impacts is not likely to impact at a population level but does have negative effects to individuals. The success of secured sites is dependent on keeping the site free of or with limited nonnative aquatic species. The eradication of nonnative aquatic species from streams is essential for establishing new populations or securing populations. Rotenone is a primary means of eradicating nonnative fish from a stream. Currently, due to a lack of a producer for Antimycin A and lack of EPA registration for other potential piscicides in development, the most effective method to remove fish is rotenone. However, the process for public coordination and other steps required on the pesticide label make it difficult and time-consuming to use rotenone under Federal law. Given the difficulty and uncertainty surrounding the use of this tool, management of nonnative aquatic species could be problematic in the future. Without this tool, management of nonnative fish will become more difficult and the success of future conservation efforts more uncertain. Due to the high uncertainty of the success of newly established populations, and the likelihood that rotenone will not be a useable tool to remove nonnative aquatic species, we did not rely on newly established populations or renovated streams in our assessment of future conditions.

In addition, the U.S. Forest Service has implemented a suite of practices to reduce the risk of high-severity fires in the range of the chubs, such as prescribed burning, mechanical thinning, and retention of large trees. These actions can help southwestern forest ecosystems adapt to climate change and reduce the risk of extreme fire behavior (Finney et al. 2005). These measures can also reduce emissions of the gases that cause climate change because long-term storage of carbon in large trees can outweigh short-term emissions from prescribed burning.

Although considerable work has been accomplished to reduce fuel loads and plans to continue that effort are documented, wildfire still poses a risk to the chubs.

Current Condition

In the SSA Report, we used AUs to describe the populations of chubs. The AUs were delineated based on the hydrological connectivity of currently occupied streams and the ability of chubs to move within or among streams. There are two types of AUs considered in the SSA Report: (1) Those composed of one occupied stream, referred to as independent AUs; and (2) those composed of two or more hydrologically connected occupied streams, referred to as complex AUs.

We determined that water availability, nonnative aquatic species, and chub population structure are the three primary risks to these species. We modeled certain components contributing to the primary risks that were most likely to have a population-level impact to both species of chub. We developed a qualitative (measuring by quality of physical and biological components rather than quantitatively) model to summarize our understanding of the risk of extinction of these species due to these factors. To model water availability, we considered stream length as a surrogate for available habitat. We recognize that stream length does not equate to the quality of habitat available, but this is the best available data we have. The effect of nonnative aquatic species was evaluated in terms of the impacts from the community of nonnatives aquatic species present in a stream and the known impacts to chubs from the nonnative aquatic species present in the stream. Chub population structure is expressed in terms

of chub abundance, number of age classes, and number of positive surveys for presence of the species. In addition, the model captures past conservation measures, such as stream renovations and newly established populations. Although not incorporated into our model, we also considered additional risk from climate change and water loss due to anthropogenic factors (e.g., surface water diversion and groundwater pumping), which is part of the water availability factor we included in our model. However, we were not able to capture additional risk from climate change and water loss due to anthropogenic factors in the model. In addition, we assessed impacts from wildfire based on the wildfire risk map developed by the U.S. Forest Service, recognizing that not all fire results in adverse effects to these chubs. Further, we considered the demographic impacts from these risks and the reduction in range. We evaluated impacts from these additional risks to each AU and the species as a whole. We considered these additional factors by evaluating their impacts to AUs and the species as a whole. For additional information on our assessment model, refer to the SSA Report at *http://www.regulations.gov*.

The current condition is expressed as our understanding of risk of extirpation now or in the near future (next 5 years). We identified four categories to communicate how we are defining risk of extirpation, described in Table 3, below. An AU categorized as minor risk has a 0 to 5 percent change of extirpation.

Table 3. Modeled Analysis Unit Ranking Categories Based on Risk of Extirpation

Category	**Extirpation Risk**
Minor Risk Extirpation	0-5%

Low Risk Extirpation	6-30%
Moderate Risk Extirpation	31-60%
High Risk Extirpation	>60%

The results of our model analysis are displayed in Tables 4, 5, and 6, below. The San Carlos River AU and the upper Salt River AU are within tribal boundaries. The available data for these areas are dated and limited. In our analysis, we consider these AUs occupied; however, we have high uncertainty in this status.

Headwater Chub

Currently, there are eight AUs over three drainage basins: Gila River, Salt River, and Verde River. Headwater chub are found in 22 streams with a collective minimum of 432 km (268 mi) of available habitat. This represents at least 48 percent of the estimated historical range and no more than a 52 percent reduction in range. Stream lengths range from 3 to 70 km (2 to 44 mi). Average stream length is 17 km (10 mi). Only three streams lack nonnative aquatic species impacting chubs. Only one AU is in the minor risk of extirpation category. There are three AUs in the low risk, and four in the moderate risk categories (see Table 4, below).

Table 4. Modeled Current Condition of Headwater Chub by Analysis Units (C=Complex AU; I=Independent AU)

Watershed	Sub-Watershed	Analysis Unit	Type/ Number of streams	Risk of Extirpation
Gila River	Lower Gila River	San Carlos	C/2	Moderate
	Upper Gila River	Three Forks	C/4	Low
Salt River	Tonto Creek	Lower Tonto Creek	C/2	Moderate
	Tonto Creek	Upper Gunn Creek	I	Moderate
	Tonto Creek	Upper Tonto Creek	C/8	Low
Verde River	East Fork Verde River	East Fork Verde River	C/5	Moderate
	Verde River	Upper Fossil Creek	I	Minor
	Verde River	Upper Wet Bottom Creek	I	Low

Once the modeled results of the current condition were determined, we then evaluated the risk from wildfire, additional risk from climate change, water loss due to anthropogenic actions, and the demographic impacts from these risk factors and reduction in range on the AUs and the species as a whole. We assessed if an AU in each risk category were to experience a wildfire, loss of connectivity, decreased water flow due to anthropogenic actions and climate change, and demographic impacts, how that would further affect the condition of the AU. We recognize that impacts from fire do not always result in adverse impacts to chubs. We then considered how this would impact the redundancy and representation of the species.

Wildfire could impact one or more AUs now or in the near future (5 years). Impacts could range from loss of individuals to loss or significant impacts to entire AUs or multiple AUs. The likelihood of wildfire now or in the near future is high; however, the severity, timing, and location of the wildfire is uncertain.

Climate change is projected to reduce the flowing stream length of river networks. However, there are other impacts from climate change that we considered but were not able to incorporate into the model. This includes the increased lengths of dry reaches within a stream, loss of connectivity within and among streams, changes in the timing and amount of snowmelt and monsoon rains, changes in the frequency and duration of droughts, and the increase in temperatures resulting in increased evaporation. Increased dry reaches can impact chub movement and dispersal. Connectivity within streams is important for headwater chubs to maintain genetic diversity. Alterations in the timing and amount of water in the spring could result in delayed or reduced reproduction and recruitment. Alterations in the timing and amount of monsoon rains could result in a decrease in refugia areas for chubs after the driest time of the year. Impacts from climate change occur throughout the range of the headwater chub and are likely to affect all streams to some degree. In addition to the reduction in water from climate change, we also evaluated impacts to chubs from the loss from surface water diversions and groundwater pumping. These impacts are likely to impact all AUs to some degree.

Lower Colorado River Basin Roundtail Chub DPS

Currently, there are 15 AUs across five drainage basins: Bill Williams River, Gila River, Little Colorado River, Salt River, and Verde River. Roundtail chub are found in 35 streams with a collective minimum of 2,098 km (1,303 mi) of available habitat. This represents at least 43 percent of the historical range and no more than a 57 percent reduction in range. The stream lengths range from 7 to 320 km (4 to 199 mi), with an average stream length of 50 km (10 mi). Only three streams lack nonnative aquatic species impacting chubs. One stream, Fossil Creek, has undergone renovation (meaning nonnatives have been removed). There are currently four newly established sites (see Table 6, below). There is only one AU in the minor risk of extirpation category. There are seven AUs in low risk, six in moderate risk, and one in high risk (see Table 5, below).

Table 5. Modeled Current Condition of Lower Colorado River Basin Roundtail DPS Analysis Units (C=Complex AU; I=Independent AU)

Watershed	Sub-Watershed	Analysis Unit	Type/ Number of streams	Risk of Extirpation
Bill Williams River	Boulder Creek	Upper Boulder Creek	C/3	Low
	Burro Creek	Burro Creek	C/4	Low
	Santa Maria River	Santa Maria River	C/4	Moderate
	Trout Creek	Trout Creek	C/3	Low
Gila River	Lower Gila River	Aravaipa Creek	I	Low
		Eagle Creek	I	Low
	Upper Gila River	Upper Gila River	I	Moderate
Little Colorado River	Chevelon Creek	Chevelon Creek	I	Low
	Clear Creek	Clear Creek	C/2	Moderate
Salt River	Upper Salt River	Salome Creek	I	High
		Upper Salt River	C/9	Moderate
Verde River	Lower Verde	Confluence	C/2	Moderate
	Fossil Creek	Upper Fossil Creek	I	Low
	Verde River	Upper West Clear Creek	I	Minor
	Verde River	Verde River	C/6	Moderate

Once the modeled results of the current condition were determined, we then evaluated the risk from wildfire, additional risk from climate change, water loss due to anthropogenic actions,

and demographic impacts from these risks factors and reduction in range on the AUs and the species as a whole. We assessed if an AU in each risk category were to experience a wildfire, loss of connectivity, decreased water flow, or demographic impacts, how that would further affect the condition (or resiliency) of the AU. We recognize that impacts from fire do not always result in adverse impacts to chubs. We then considered how this would impact the redundancy and representation of the species.

Wildfire could impact one or more AUs now or in the near future (5 years). Impacts could range from loss of individuals to loss or significant impacts to entire AUs or multiple AUs. The likelihood of wildfire now or in the near future is high; however, the severity, timing, and location of the wildfire is uncertain.

Climate change is projected to reduce the flowing stream length. However, there are other impacts from climate change that we considered but were not able to incorporate into the model. This includes the increased lengths of dry reaches within a stream, loss of connectivity within and among streams, changes in the timing and amount of snowmelt and monsoon rains, changes in the frequency and duration of droughts, and the increase in temperatures resulting in increased evaporation. Increased dry reaches can impact chub movement and dispersal. Connectivity within and among streams is important for the lower Colorado River basin roundtail chub DPS to maintain genetic diversity. Alterations in the timing and amount of water in the spring could result in delayed or reduced reproduction and recruitment. Alterations in the timing and amount of monsoon rains could result in a decrease in refugia areas for chubs after the driest time of the year. Impacts from climate change occur throughout the range of the lower

Colorado River basin roundtail chub DPS and are likely to affect all streams to some degree. In addition to the reduction in water from climate change, we also evaluated the impacts to chubs from the loss from surface water diversions and groundwater pumping. These impacts are likely to impact all AUs to some degree.

Lower Colorado River Basin Roundtail Chub DPS's Newly Established Sites

There are currently four newly established sites for the lower Colorado River basin roundtail chub DPS (see Table 6, below), each site is an individual AU. These are relatively newly established AUs, and their success is unclear at this time. The Blue River site is the only site that has demonstrated reproduction. The remaining three sites have yet to show any reproduction. We analyzed the current condition of these AUs using the same method that we used to analyze the headwater chub and extant populations of lower Colorado River basin roundtail chub DPS, meaning that we analyzed these using the model and then considered wildfire impacts, additional climate change impacts, water loss due to anthropogenic actions, and the demographic effects from these factors. Again, we recognize that impacts from fire do not always result in adverse impacts to chubs. However, we present the results separately due to the uncertainty of their success.

Table 6. Modeled Current Condition of Lower Colorado River Basin Roundtail Chub DPS's Newly Established Analysis Units (C=Complex AU; I=Independent AU)

Drainage Basin	**Analysis Unit**	**Type/ Number of**	**Risk of**

		streams	**Extirpation**
Gila River	Blue River	I	Low Risk
Salt River	Ash Creek	I	Low Risk
Verde River	Gap Creek	I	Low Risk
Verde River	Roundtree Canyon	I	Low Risk

Future Condition Analysis

We analyzed the future risk of extirpation of each AU using the same model we used to assess current condition. However, we added a metric to assess conservation measures. We used the current condition of nonnative aquatic species, water availability, and chub population structure as the baseline to analyze projected future impacts. As stated in the current condition, we modeled water availability using stream length as a surrogate for available habitat. To model projected future impacts from climate change, we applied a reduction in length to the baseline stream length (i.e., water availability) to all streams. Under the current condition, the nonnative aquatic species were evaluated in terms of the impacts from the community of nonnative aquatic species present in a stream and the known impacts to chubs from the nonnative aquatic species present in the stream. To project future impacts from nonnatives aquatic species, we applied an increase in the impacts from the community of nonnative aquatic species present to a percentage of streams. We did not project future impacts to chub population structure because the projected future risk to the chubs is what we are projecting. To measure conservation efforts, we projected the future establishment of new populations and the renovation of streams.

Given our uncertainty regarding if or when streams or AUs occupied by chubs will experience an increase in nonnative aquatic species, a reduction in water in the future, or conservation actions, we have qualitatively forecasted what both species may have in terms of resiliency, redundancy, and representation under four different possible future scenarios based on our understanding of the risks to these species. Our modeling allowed us to review four future scenarios of risk to AUs from nonnative aquatic species and water availability. These scenarios extend to the year 2046, about 30 years from present. In addition, we included an assessment of the potential for future conservation actions within each scenario.

To measure impacts from nonnative aquatic species in the future scenarios, we evaluated an increase in the level of impact from the nonnative aquatic species community across a percentage of streams because it is unlikely that all streams will be affected by increased impacts from nonnative aquatic species. It is more realistic that a portion of streams will have increased effects from nonnative aquatic species. Impacts due to reduction in water availability were assumed to occur throughout all streams because impacts from climate change, the largest driver of water availability, occur at a landscape scale; however, the future scenarios incorporate various levels of climate change severity to account for the uncertainty in future climate change projections.

We identified two levels of conservation: a high management option and a low management option. The high management option projects that there will be two streams that are renovated or secured (eliminating nonnatives), and two new populations will be established per species. The low management option only projects one new population being established per

species. For the two new projected populations for each chub, we did not select real streams but identified a set of conditions to represent a proxy stream similar to what would be considered in selecting a real site for a new population. We randomly selected drainage basins where the new population sites would be implemented. For the purposes of the model, we assumed all of these conservation efforts would result in populations that have reproduction and recruitment.

Table 7. Future Scenarios Analyzed in the Model for Headwater Chub and Lower Colorado River Basin Roundtail Chub DPS

	Nonnative Aquatic Species		Water Availability	Conservation
Scenario	Percent of streams impacted by nonnatives	Nonnative community level increase	Percent of decrease in stream length	New populations, renovation, securing
1	13	1	-4	High management
2	13	2	-8	High management
3	13	2	-8	Low management
4	45	1	-20	Low management

The below results are from the model analysis; however, it is important to note that our model does not capture all risks affecting these species. For analyzing the future condition, the model captures certain components contributing to the primary risks to the species (nonnative aquatic species and water availability) and conservation measures (establishing new populations and renovating existing populations). Although not incorporated into our model, we also considered additional risk from climate change and water loss due to anthropogenic factors (e.g., surface water diversion and groundwater pumping), which is part of the water availability factor

we included in our model. However, we were not able to capture additional risk from climate change and water loss due to anthropogenic factors in the model. In addition, we assessed impacts from wildfire based on the wildfire risk map developed by the U.S. Forest Service. As clarified in the *Risk Factors for Headwater Chub and the Lower Colorado River Basin Roundtail Chub DPS* section of this proposed rule, we recognize that fire does not always result in adverse effects to these species. Further, we considered the demographic impacts to these risks and the reduction in range. We evaluated impacts from these additional risks to each AU and the species as a whole.

Future Condition Model Results

I. Headwater Chub

The high management options projects that two new AUs will be established and two streams will be renovated. The low management options projects that one new AU will be established and no streams will be renovated. Consequently, scenarios 1 and 2 resulted in 10 AUs, instead of 8, because both of these scenarios incorporate the high management option. Scenarios 3 and 4 resulted in nine AUs due to the low management option projecting only one newly established population. As a result of the established populations and the renovation populations, the representation and redundancy of the species increased. However, the resiliency of some of the AUs is diminished due to the increased risks from nonnative aquatic species and reduced stream length.

Table 8. Modeled Future Condition of Headwater Chub Analysis Units

Analysis Unit Name	Current Condition	Scenario 1	Scenario 2	Scenario 3	Scenario 4
San Carlos Complex	Moderate	Moderate	Moderate	Moderate	Moderate
Three Forks Complex	Low	Low	Low	Low	Moderate
Lower Tonto Creek Network	Moderate	Moderate	Moderate	Moderate	Moderate
Upper Gunn Creek	Moderate	Moderate	Moderate	Moderate	Moderate
Upper Tonto Creek Complex	Low	Low	Low	Low	Low
New Population A	Not applicable	Minor	Minor	Minor	Minor
East Verde River Complex	Moderate	Low	Low	Moderate	Moderate
Fossil Creek	Minor	Low	Moderate	Moderate	Low
Wet Bottom Creek	Low	Low	Low	Low	Low
New Population B	Not applicable	Minor	Minor	Not applicable	Not applicable

II. Lower Colorado River Basin Roundtail Chub DPS

The high management options projects that two new AUs will be established and two streams will be renovated. The low management options projects that one new AU will be established and no streams will be renovated. Consequently, scenarios 1 and 2 resulted in 17 AUs, instead of 15, because both of these scenarios incorporate the high management option.

Scenarios 3 and 4 resulted in 16 AUs due to the low management option only projecting one newly established population. As a result of the established populations and the renovation populations, the representation and redundancy of the species increased. However, the resiliency of some of the AUs is diminished due to the increased risks from nonnative aquatic species and reduced stream length. However, the increased risk did not elevate the ranking to the next risk category.

Table 9. Modeled Future Condition of Lower Colorado River Basin Roundtail Chub DPS Analysis Units

Analysis Unit	Current Condition	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Boulder Creek Complex	Low	Low	Low	Low	Low
Burro Creek Complex	Low	Low	Low	Low	Low
Santa Maria River Complex	Moderate	Moderate	Moderate	Moderate	Moderate
Trout Creek Complex	Low	Low	Low	Low	Moderate
New Population C	Not applicable	Minor	Minor	Minor	Minor
Aravaipa Creek	Low	Low	Low	Low	Low
Eagle Creek	Low	Low	Low	Low	Low
Upper Gila River	Moderate	Moderate	Moderate	Moderate	Moderate

Complex					
Chevelon Creek	Low	Moderate	Moderate	Moderate	Moderate
Clear Creek Complex	Moderate	Moderate	Moderate	Moderate	Moderate
Salome Creek	High	High	High	High	High
Upper Salt River Complex	Moderate	Moderate	Moderate	Moderate	Moderate
Confluence Reach Complex	Moderate	Moderate	Moderate	Moderate	Moderate
Fossil Creek	Low	Low	Low	Low	Low
Upper West Clear Creek	Minor	Minor	Minor	Minor	Low
Verde River Complex	Moderate	Moderate	Moderate	Moderate	Moderate
New Population D	Not applicable	Minor	Minor	Not applicable	Not applicable

III. Lower Colorado River Basin Roundtail Chub DPS's Newly Established Sites

There are currently four established sites for the lower Colorado River basin roundtail chub DPS (see Table 10, below), and each site is an individual AU. These are relatively newly established AUs, and their success is unclear at this time. The Blue River site is the only site that has demonstrated reproduction. The remaining three sites have yet to show any reproduction. Consequently, we analyzed these AUs separately because of the uncertainty of their success.

Results for the Lower Colorado River basin roundtail chub DPS newly established populations (Blue River, Ash Creek, Gap Creek, and Roundtree Canyon) are captured in Table 10.

Table 10. Modeled Future Condition of Lower Colorado River Basin Roundtail Chub DPS's Newly Established Analysis Units (C=Complex AU; I=Independent AU)

Drainage Basin	Analysis Unit	Current	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Gila River	Blue River	Low	Low	Moderate	Moderate	Low
Salt River	Ash Creek	Low	Moderate	High	High	High
Verde River	Gap Creek	Moderate	Moderate	High	High	High
Verde River	Roundtree Canyon	Low	Moderate	High	High	High

Summary

Based on the risk factor discussion above, scenarios 1 and 3 are the most likely scenarios. We are moderately certain that nonnative aquatic species will not impact 45 percent of the streams throughout the range of either species. Consequently, scenario 4 is not a realistic scenario, but it does demonstrate a negative future condition for comparison to the other scenarios. Scenario 2 is similar to scenario 3, with different conservation measures (see Table 7, above). Given the uncertainty in the success and feasibility of the conservation measures, we consider it important to evaluate a scenario with low management options. Consequently, we

analyzed the results from scenario 3, rather than scenario 2. Scenarios 1 and 3 vary in the level of impacts from nonnative aquatic species, amount of decrease in stream length, and the level of conservation measures. There is uncertainty in the level of impacts from nonnative aquatic species and climate change. Further, there is uncertainty in the level, feasibility, or effectiveness of conservation measures. By considering both scenario 1 and 3, we address some of this uncertainty. Therefore, the most informative scenarios are scenarios 1 and 3, where impacts from nonnative aquatic species are likely to increase in a percentage of streams across the range of each species, stream lengths will be reduced, and some level of conservation management will be implemented. In addition to the model results, we also assessed risk from wildfire, additional risk from climate change, water loss due to anthropogenic factors, demographic impacts from these risks factors, and the reduction in range, as described in the *Risk Factors for Headwater Chub and the Lower Colorado River Basin Roundtail Chub DPS* and *Current Condition* sections, above.

Viability

In the SSA Report, we used AUs to describe the populations of chubs. The AUs were delineated based on the hydrological connectivity of currently occupied streams and the ability of chubs to move within or among streams. There are two types of AUs considered in this SSA Report: (1) Those composed of one occupied stream, referred to as independent AUs; and (2) those composed of two or more hydrologically connected occupied streams, referred to as complex AUs.

Headwater Chub

Currently, at least 48 percent of the estimated historical range is occupied and there has been no more than a 52 percent reduction in range. Occupancy is within 22 streams, with a collective minimum of 432 km (268 mi) of available habitat, dispersed over eight AUs across three drainage basins. Three (38 percent) AUs are isolated, and five (62 percent) AUs have some hydrologic connection to each other. Headwater chub populations are naturally fragmented due to the individual hybridization events that created the species. Due to the multiple hybridization events in separate streams that likely gave rise to headwater chub, there are differences between the occupied streams across the occupied range deriving from the specifics of the founding populations and subsequent events that may have reduced population sizes that affected that diversity (Dowling et al. 2008, pp. 10–11). Most of their genetic variation occurs among populations, each of which tends to be distinctive. Each AU is geographically isolated from the other AUs even in the same drainage basin. The significance of isolation in shaping each population highlights the importance of maintaining each independently to preserve the unique genetic variation (Dowling et al. 2008, p. 2). Maintaining representation in the form of genetic or ecological diversity is important to retaining the capacity of the chub to adapt to future environmental changes.

Six of the eight AUs are located in adjoining drainages: three in the Salt River (upper and lower Tonto Creek complexes and Gunn Creek independent AUs) and three in the Verde River (East Verde River complex and Fossil and Wet Bottom creeks independent AUs). The result is a distribution with 64 percent of the occupied area within immediate proximity to each other in

two adjacent drainage basins, which is a concern for catastrophic events (such as floods). The remaining two complexes, San Carlos River and Three Forks, are in separate drainage basins from the other six and each other, and are not likely to be affected by the same catastrophic natural or anthropogenic event. This configuration creates a concern for maintaining redundancy in the future due to a catastrophic event.

There are eight streams from various AUs of approximately 5 km (3 mi) or less in length. These streams are at a higher risk of extirpation from catastrophic events than are longer streams. Further, there are two AUs of approximately 5 km (3 mi) or less, in which a catastrophic event could result in the loss of these AUs and reduce redundancy of the species. In addition, San Carlos River and its tributary Ash Creek within the Gila River drainage basin are on tribal lands, and we have high uncertainty regarding the presence of chubs.

Lower Colorado River Basin Roundtail Chub DPS

Currently, about 47 to 52 percent of historical range is occupied (or 48 to 53 percent reduction in range). Occupied areas are dispersed over 35 streams within 15 AUs across five drainages. Information about roundtail chub indicated that historically there was greater connectivity and subsequent relatedness over the region, and development of populations in isolation from other roundtail chub was not the normal condition across most of the historical range except in the Bill Williams River and Little Colorado River drainages. Unlike the headwater chub, the roundtail chub's historical connectivity within the Gila, Salt, and Verde Rivers promoted less genetic diversity over the range; however, the Bill Williams and Little

Colorado rivers are isolated from that connectivity and are more unique. However, roundtail chub are extirpated from several large riverine streams that provided connectivity across most of the historically occupied range. This has resulted in the recent isolation of AUs even within the same drainage basin. Nine AUs (about 60 percent) are isolated and are not able to naturally recolonize. If a catastrophic event such as wildfire or severe drought occurs in one of these nine populations, it could be extirpated. Variation within populations and connectivity may be more of an issue for roundtail chub in the DPS than with headwater chub. Maintaining representation in the form of genetic or ecological diversity is important to retaining the capacity of the roundtail chub to adapt to future environmental changes.

There are eight streams from various AUs of approximately 5 km (3 mi) or less. These streams are at a higher risk of extirpation from catastrophic events than are longer streams. In addition, one AU is approximately 5 km (3 mi) or less, putting it at higher risk of extirpation due to a catastrophic event, leading to reduced redundancy. In addition, there seven streams within the Upper Salt River drainage basin located on tribal lands where we have high uncertainty regarding the presence of chubs. We consider these streams occupied, but this could be overestimating the range of the headwater chub and the lower Colorado River basin roundtail chub DPS.

In the Little Colorado River drainage basin, loss of one of the two occupied streams would impair redundancy. For the Verde River Complex and Upper Salt River Complex AUs, loss of any stream with documentation of recruitment would likely impair the entire complex. The survey data suggest that some streams in the Verde River Complex and Upper Salt River

Complex AUs have more recruitment events than others but we do not fully understand how the chub populations are maintained across the entire complex. Under these conditions, loss of a stream with sustained recruitment would affect redundancy across the entire AU. For the Gila River drainage basin, loss of the Eagle Creek AU would effectively eliminate the upper portion of the Gila River drainage basin. The loss of the Aravaipa Creek AU would effectively eliminate the lower portion of the Gila River drainage basin. For the Bill Williams River drainage basin, the loss of one AU complex would reduce redundancy but not necessarily impair redundancy. However, the loss of both AU complexes would impair redundancy because of the potential for loss of a genetic management unit.

Determinations

Section 4 of the Act (16 U.S.C. 1533), 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(a)(1) of the Act, we may list a species based on (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Under section 4(b)(1)(a), the Secretary is to make endangered or threatened determinations under section 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. We

have carefully assessed the best scientific and commercial data available regarding the past, present, and future threats to the headwater chub and lower Colorado River basin roundtail chub DPS.

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 used the best available scientific and commercial data to evaluate the viability (and thus risk of extinction) for the headwater chub and the lower Colorado River basin roundtail chub DPS to determine if they meet the definition of an endangered or threatened species.

Summary of Analysis

The biological information we reviewed and analyzed as the basis for our findings is documented in the SSA Report (Service 2015, entire), a summary of which is provided in the **Background** section of this proposed rule. The projections for the condition of populations are based on our expectations of the risks (in other words, threats) that may have population-level effects currently or in the future. The risks we evaluated in detail are habitat loss and degradation due to groundwater pumping and surface water diversion (Factor A from the Act), and predation, competition, and harassment from nonnative aquatic species (Factors C and E from the Act). For nonnative aquatic species and reduction in water, we also considered the exacerbating effects of climate change (Factor E from the Act). We reviewed, but did not

evaluate in further detail because of a lack of population-level effects, the effects of recreation (Factor B from the Act), grazing, forestry practices, roads, and mining (Factor A from the Act). The overall results of the status assessment found that the best available information indicates that the range of the headwater chub and the lower Colorado River basin roundtail chub DPS have decreased, with multiple streams now extirpated, likely due to nonnative aquatic species and loss of habitat (i.e., water).

The purpose of the status assessment was to characterize the future condition of the headwater chub and the lower Colorado River basin roundtail chub DPS in the face of risks and conservation efforts described above in the **Background** section. In the SSA Report, we described the viability of the headwater chub and the lower Colorado River basin roundtail chub DPS in terms of resiliency, redundancy, representation now, including the next 5 years, and over the next 30 years under four likely scenarios. We have determined that scenarios 1 and 3 are the most likely future scenarios. Our forecasts take into consideration the four newly established sites and one restoration site for the lower Colorado River basin roundtail chub DPS. In addition, our analysis considers wildfire risk, additional climate change impacts, water loss due to anthropogenic actions, and demographic impacts from these factors and the reduction in the range. We recognize the fire does not always result in adverse effects to these chubs. We evaluated impacts from these additional risks to each AU and the headwater chub and the lower Colorado River basin roundtail chub DPS as a whole.

Application of Analysis to Determinations

The fundamental question before the Service is whether the headwater chub and the lower Colorado River basin roundtail chub DPS warrants protection as endangered or threatened under the Act. To determine this, we evaluate the projections of extinction risk, described in terms of the condition and distribution of current (including the next 5 years) and future populations. As population condition declines and distribution shrinks, species' extinction risk increases and overall viability declines.

As described in the determinations below, we first evaluated whether the headwater chub and the lower Colorado River basin roundtail chub DPS are in danger of extinction throughout their ranges now (an endangered species). We then evaluated whether they are likely to become in danger of extinction throughout their ranges in the foreseeable future (a threatened species). We finally considered whether the headwater chub and the lower Colorado River basin roundtail chub DPS are an endangered or threatened species in a significant portion of their ranges (SPR).

Headwater Chub Determination

Endangered Species Throughout Range

I. Standard

Under the Act, an endangered species is any species that is "in danger of extinction throughout all or a significant portion of its range." Because of the fact-specific nature of listing determinations, there is no single metric for determining if a species is currently in danger of

extinction. We used the best available scientific and commercial data to evaluate the viability (and thus risk of extinction) for the headwater chub to determine if it meets the definition of an endangered species. In this proposed rule, we use a description of the condition of populations to describe the viability of headwater chub then determine the species' status under the Act.

II. Evaluation

To assist us in evaluating the status of the headwater chub, we evaluated the risk factors that we found may have potential population-level effects now. This included nonnative aquatic species, water availability, and chub population structure, which we assessed in our model. In addition, this included current risk from wildfire, climate change, water loss due to anthropogenic actions, and demographic effects from these risks factors and the reduction in range; however, these were not analyzed in the model. All of these factors affect the resiliency of AUs for the headwater chub.

For headwater chub, at least 48 percent of the estimated historical range remains and no more than a 52 percent of the range has been reduced from the historical range. Nonnative aquatic species occupy almost all currently occupied chub streams, and we analyzed impacts to these streams and AUs through the model. Nonnative aquatic species and chubs have coexisted for some time in several of these streams, but the reasons for this are unclear. There are three streams for headwater chub that are currently free of nonnative aquatic species into which nonnatives could expand or be introduced.

In the model, we analyzed the stream length as a measure of water availability. This provided a current condition of the amount of water in a stream at the driest time of year. This captured climate change and anthropogenic action (surface water diversions and groundwater pumping) impacts to the stream. Wildfire is not analyzed in the model, but we did consider impacts from wildfire. Currently, wildfire could occur almost anywhere within the range of this species and impact one or more streams or entire AUs. However, impacts to the headwater chub are dependent on the severity, location, and timing of the fire, as well as the size of the stream.

Since this species developed as a result of multiple independent hybridization events over time (Rinne 1976; Rosenfeld and Wilkinson 1989; DeMarais et al. 1992; Dowling and DeMarais 1993; Minckley and DeMarais 2000; Gerber et al. 2001; Schwemm 2006; Schönhuth et al. 2014), it is important to maintain it independently to preserve the unique genetic variation (Dowling et al. 2008, p. 2). The genetic diversity of headwater chub is best represented in differences within its populations, each of which tends to be distinctive.

The renovation effort in Fossil Creek for headwater chub (and for roundtail chub in the lower Colorado River basin) has proven successful, but such an effort requires a large commitment of resources including funding and personnel.

III. Finding for Headwater Chub

Our review found that eight AUs currently exist within the historical range of the headwater chub across three drainage basins. We defined the minor risk category as a 0 to 5

percent current risk of extirpation, the low risk category as a 6 to 30 percent current risk of extirpation, and the moderate risk category as a 31 to 60 percent current risk of extirpation. The model output categorized one AU as minor risk, three AUs as the low risk, and four as the moderate risk categories.

Four AUs are projected as currently having a minor or low risk of extirpation. We consider the one AU in the minor risk category, Fossil Creek, to be resilient because it contains very few nonnative aquatic species, it has a stream length of over 15 km (9 mi), and chub population structure is high (meaning chubs are abundant and recruitment is high). All these components increase the AU's ability to withstand a stochastic event such as wildfire and weather, which are the other risks we considered in our assessment. Based on this, resiliency is sufficient for this AU, and the risk of extirpation is 0 to 5 percent.

Although less resilient than an AU in the minor risk category, the AUs in the low risk category are also considered resilient, because they have low nonnative aquatic species, sufficient stream length, and/or good chub population structure (chubs are common to abundant and recruitment is moderate to high). These components increase the AUs' ability to withstand a stochastic event such as wildfire and drought, which are the other risks we considered in our assessment. However, their ability to withstand a stochastic event is less than an AU in the minor risk, and the range of extirpation risk is greater (6 to 30 percent). The range in risk of extirpation is a factor of the variability in the level of impacts from nonnative aquatic species, water availability, and chub population structure, as well as the uncertainty in the species' response from these risks factors because each AU is different.

Impacts from nonnative aquatic species and water availability, as well as wildfire, climate change, and demographics, are affecting AUs in the minor and low risk categories, but these AUs are currently maintaining chubs and are therefore likely to withstand a stochastic event. In addition, there are two AUs in the moderate risk category that are close to the low risk category score, indicating that while they are in the moderate category they are at the low end of this category (i.e., closer to low risk).

While impacts from climate change are likely currently, and are impacting chub populations at some scale, they are not having population-level impacts to all AUs at this time.

Nonnative aquatic species occur in all but three streams that headwater chub occupy. While chubs coexist with nonnative aquatic species in several streams, this does not mean that nonnative aquatic species are not impacting chubs; however, the AUs are persisting currently.

We consider the species to have sufficient redundancy and representation, and a number of sufficiently large populations, so that the species is able to withstand catastrophic events. The four AUs identified as minor and low risks are currently spread over a large geographical area, such that all the AUs are highly unlikely to experience a catastrophic event that would impact all AUs now. Further, the current range of the species includes AUs that represent the known diversity of ecological settings and genetic materials for the headwater chub. The current and ongoing threats are not likely to impact all remaining populations significantly now. Certain risks, such as climate change, move slowly across the landscape, and demographic impacts take

time to impact a population. The increase or spread of nonnative aquatic species moves faster than climate change or demographics, but it will likely take a few years for a nonnative aquatic species to expand in a currently occupied stream or become established in a new stream. Wildfire is likely to have immediate impacts, but it is highly unlikely that wildfire will impact all AUs at the current time. As a result, it is unlikely that a single stochastic event (e.g., drought, wildfire) or catastrophic event will affect all known extant populations equally or simultaneously now. It would require several stochastic events or catastrophic events over a number of years to bring the headwater chub to the brink of extinction due to those factors.

This estimate of the condition and distribution of populations provides sufficient resiliency, representation, and redundancy for the species. The primary threats to the species (nonnative aquatic species, water availability, and climate change) are not currently having population-level effects to all AUs across the range of the headwater chub. Catastrophic or stochastic events in the present are not likely to have population-level impacts to all AUs; consequently the risk of extinction is sufficiently low that the species does not meet the definition of endangered under the Act. Based on the above information, we conclude that the headwater chub does not meet the definition of an endangered species under the Act.

Threatened Species Throughout Range

Having found that the headwater chub is not endangered throughout its range, we next evaluated whether this species is threatened throughout its range.

I. Standard

Under the Act, 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." The foreseeable future refers to the extent to which the Secretary can reasonably rely on predictions about the future in making determinations about the future conservation status of the species (U.S. Department of Interior, Solicitor's Memorandum, M-37021, January 16, 2009). A key statutory difference between an endangered species and a threatened species is the timing of when a species may be in danger of extinction, either now (endangered species) or in the foreseeable future (threatened species). The foreseeable future refers to the extent to which the Secretary can reasonably rely on predictions about the future in making determinations about the future conservation status of the species.

II. Foreseeable Future

To assist us in evaluating the status of the species in the foreseeable future, we evaluated the risk factors that we found may have potential population-level effects over time. This included nonnative aquatic species, water availability, and conservation actions, which we assessed in our model. In addition, we considered the future risk from wildfire, water loss due to future anthropogenic actions, and demographic impacts from these risk factors, as well as reduction in range. In considering the foreseeable future, we forecasted the future status of the headwater chub as described by the future condition of the AUs. This projected future condition was based on the risk factors and conservation actions affecting the species, and the uncertainties

associated with these factors and actions. We consider 30 years from now a reasonable time to reliably predict the future conservation status of this species.

The best available information indicates that we have a high level of certainty out to 30 years for climate change risks, which is an essential consideration for the foreseeable future. Therefore, our analysis of the status of the species to the foreseeable future uses a timeframe of 30 years. The outputs of Jaeger et al.'s (2014, entire) downscaled climate forecasting models project climate scenarios to midcentury (approximately 2050) (IPCC 2014; Jaeger et al. 2014, entire). Jaeger et al. (2014, entire) focuses on the Verde River Basin in Arizona over current (1988-2006) and midcentury (2046-2064) time periods. This study was useful because the headwater chub occurs in the Verde River Basin and the study focuses on impacts to native fish. Since the potential effects of climate change on flowing regions within streams and connectivity within and among streams, and the exacerbated impacts from nonnative aquatic species and demographics (i.e., age structure and genetics) due to climate change, were primary considerations in our status assessment, we considered climate change predictions essential in the foreseeable future. However, we did not extend our forecasting beyond the midcentury because of uncertainty in the climate change models and in the response of the species beyond approximately 2046.

III. Evaluation

To assist us in evaluating the status of the species, we evaluated the risk factors that we found may have potential population-level effects over a 30-year time period. This included

nonnative aquatic species, water availability, and conservation actions, which we assessed in our model. In addition, we considered the future risk from fire, additional climate change, future anthropogenic actions, and demographic effects from these risks factors, as well as reduction in range; however, these were not analyzed in the model. We evaluated impacts from these additional risks to each AU and the species as a whole.

Chubs are affected not only by the quantity and quality of water, but also by the timing and spatial distribution of water. In the model, we analyzed the reduction in stream length as an impact from climate change. However, climate change models project that over the next 50 years: (1) Future water levels and stream base flows are expected to continue to decrease in the Verde River in the lower Colorado River basin; (2) the frequency of stream drying events in the Verde Valley is expected to increase; (3) the length of the remaining flowing reaches of streams in the Verde Valley (or region) will be reduced; and (4) network-wide hydrologic connectivity for native fishes will be reduced (both over the course of the year and during spring spawning months). Climate change is also projected to alter the timing and amount of snowmelt and monsoon rains, and the frequency and duration of droughts. Climate change will also increase temperature, resulting in increased evaporation. Climate change is also likely to exacerbate the effects of water loss, reduction in hydrological connectivity, nonnatives, and species interactions (impacting demographics). All of these factors reduce the resiliency of AUs for the headwater chub. However, the certainty of the model projections decreases as the projected timeframe increases. Further, the severity of climate change impacts depicted in climate models varies depending on the scenario being evaluated, with some projecting low changes (e.g., increased ambient temperature and decreased rainfall) in carbon dioxide and others projecting high

changes. To address this uncertainty, we considered different levels of impacts to these species under various scenarios. Impacts from climate change are likely to affect all streams and AUs within the range of the headwater chub over the next 30 years.

In the model, we analyzed the stream length as a measure of water availability. This provided a current condition of the amount of water in a stream at the driest time of year. This captured climate change and anthropogenic action (surface water diversions and groundwater pumping) impacts to the stream. Wildfire is not analyzed in the model, but we did consider impacts from wildfire. Currently, wildfire could occur almost anywhere within the range of this species and impact one or more streams or entire AUs. However, impacts to the headwater chub are dependent on the severity, location, and timing of the fire, as well as the size of the stream.

As part of the foreseeable future, we also considered the likely reduction in water availability as a result of increased human demand for water, resulting in increased surface water diversions and groundwater pumping. Demand for water is highly likely to increase as human populations are predicted to increase, affecting the timing, amount, and distribution of water within streams. However, population growth, and the exact location of that population growth, is uncertain. Further, the timing and amount of water consumed is uncertain. To address this uncertainty, we considered different levels of impacts to a subset of streams or AUs.

Nonnative aquatic species occupy almost all currently occupied chub streams, and we analyzed impacts to these streams and AUs through the model. Nonnative aquatic species and chubs have coexisted for some time in several of these streams, but the reasons for this are

unclear. We expect that nonnative aquatic species will continue to persist in most if not all of the streams they currently occupy and that nonnative impacts will increase in a percentage of streams across the range of this species. In addition, there are three streams for headwater chub that are currently free of nonnative aquatic species into which nonnatives could expand or be introduced.

The projected effects to chubs from nonnative aquatic species are likely to be exacerbated by climate change, but this was not analyzed in the model. However, we do consider this in our analysis. As the available watered segments decrease, the interactions between nonnative aquatic species and chubs increase, with more larvae and young-of-the-year removed from the chub populations dues to predation by nonnative aquatic species. In addition, resources become more limited, and the competition for these resources increases. Further, the reduction in water will likely decrease the water quality (e.g., decreased dissolved oxygen, temperature increases, changes in pH, and nutrient loading), which nonnative aquatic species are likely more capable of adapting to than chubs.

Since this species developed as a result of multiple independent hybridization events over time (Rinne 1976; Rosenfeld and Wilkinson 1989; DeMarais et al. 1992; Dowling and DeMarais 1993; Minckley and DeMarais 2000; Gerber et al. 2001; Schwemm 2006; Schönhuth et al. 2014), it is important to maintain the species independently to preserve the unique genetic variation (Dowling et al. 2008, p. 2). The genetic diversity of headwater chub is best represented in differences within its populations, each of which tends to be distinctive.

We have a moderate to high level of uncertainty regarding the success of the establishment of new populations. (For example, of the four newly established populations of roundtail chub in the lower Colorado River basin only one (Blue River) has demonstrated reproduction. One potential factor is the size of the site---Blue River is much larger than the other three sites.) The renovation effort in Fossil Creek has proven successful. However, such an effort requires a large commitment of resources including funding and personnel. While attempts at establishing new populations in the future are likely, the success of these sites is uncertain. In addition, the availability of funds and personnel in renovating another site like Fossil Creek is uncertain. Future scenarios projected in our model include conservation actions (establishment of new populations and securing sites), and the uncertainty of success of these sites.

IV. Finding for Headwater Chub

We used the same categories to categorize the risk of extirpation in the foreseeable future (until 2046) as discussed above in the "III. Evaluation" section. We determined that scenarios 1 and 3 are most likely and therefore most useful in making our determination. The model output for scenario 1 projected 10 AUs due to the high management option projecting two newly established populations and two renovation sites. The projected risk of extirpation by 2046 for the 10 AUs were: two AUs in minor risk, five in low risk, and three in moderate risk. The two AUs in minor risk of extirpation are the newly established sites, and two of the five AUs in low risk are the renovation sites. Scenario 3 projected nine AUs due to the low management option projecting only one newly established population. The projected risk of extirpation by 2046 for

the nine AUs were: one AU in minor risk, three in low risk, and five in moderate risk. The one AU in the minor risk is a newly established site.

We consider AUs within the minor to low risk categories to have sufficient resiliency in the future because they contain very few nonnative aquatic species, have long stream length, and have a high chub population structure. All these components increase the AUs' ability to withstand a stochastic event such as wildfire and weather, which are the other risks we considered in our assessment. Under the current condition, the one AU (Fossil Creek) that ranked in the minor risk category was projected to experience an increase in nonnative aquatic species and a reduction in stream length in the future scenarios. These projected impacts resulted in this AU ranking in the low risk under scenario 1 and the moderate risk under scenario 3. This demonstrates the impacts that nonnative aquatic species and water availability have on AUs. The reduced resiliency of this AU affects the redundancy and representation of the species as a whole.

The two AUs in scenario 1, and the one AU in scenario 3, that ranked in the minor risk category are the projected newly established sites. In addition, one of the AUs in the low risk category under scenario 1 is a renovation site, which under the current condition was ranked as moderate risk. Given the high uncertainty in the success of newly established and renovated sites, these are not reliably considered resilient in the future, and therefore we did not consider these in our determination. This leaves four AUs that ranked in the low risk category in scenario 1 and three in scenario 3. Although less resilient than an AU in the minor risk category, the AUs in the low risk category are also considered resilient, because they have low nonnative aquatic

species, sufficient stream length, and good chub population structure. Two of these rank closely to the moderate risk category in scenario 1 and three in scenario 3. This leaves two AUs under scenario 1 and scenario 3 that we consider resilient enough to withstand future stochastic events.

Nonnative aquatic species occur in all but three streams that headwater chub occupy. While chubs coexist with nonnative aquatic species in several streams, this does not mean that nonnatives are not impacting chubs. Further, climate change is likely to exacerbate water loss, reduction in hydrological connectivity, nonnative aquatic species, and species interactions (impacting demographics), resulting in increased competition from and predation by nonnatives. Since climate change is likely to affect all streams to varying degrees, it is likely that impacts from nonnative aquatic species will increase in a portion of streams throughout the range of the headwater chub. The level of increased impacts from nonnative aquatic species is dependent on the condition of the chubs and nonnatives in that AU, and the level of impacts from climate change.

The occurrence of wildfire within the headwater chub's range is highly likely. However, the severity, location, and impacts to chubs are uncertain. Over a 30-year period, multiple wildfires could impact multiple AUs. Impacts could range from loss of individuals to loss of streams to loss of AUs. Demand for water is highly likely to increase as human populations are predicted to increase, affecting the timing, amount, and distribution of water within streams. In addition, the synergistic impacts from the increased effects from wildfire, additional impacts from climate change, water loss due to anthropogenic actions, and demographic effects from

these risks factors increase the likelihood and severity of stochastic impacts across the range of the species.

The projected number of AUs in moderate risk is three and five under scenarios 1 and 3, respectively (33 to 55 percent, respectively). These AUs have moderate to high nonnative aquatic species, low to moderate stream lengths, and low to moderate chub abundance. These are not considered resilient enough to withstand stochastic events in the foreseeable future. As stated above, the synergistic impacts from the increased impacts from wildfire, additional impacts from climate change, water loss due to anthropogenic actions, and demographic effects from these risks factors increase the likelihood and severity of stochastic impacts across the range of the species. This increase in likelihood and severity increases the risk of extirpation for these AUs in the moderate risk category. Over the 30-year period of the foreseeable future, the risk from demographic (change in age structure and recruitment of populations) and environmental stochasticity (wildfire and weather) may have effects to all AUs (or populations) in the moderate risk category.

In addition, the model projects that three (38 percent) AUs would be isolated and only five (62 percent) AUs would retain some hydrologic connection. There are projected to be eight streams of approximately 5 km (3 mi) or less in length. These streams would be at a higher risk of extirpation due to stochastic and catastrophic events. The loss of these streams from an AU would reduce the resiliency of that AU. Further, there would be two AUs of approximately 5 km (3 mi) or less. These AUs would be at a higher risk of extirpation due to stochastic and catastrophic events.

The AUs are projected to exist across the historical range; however, 64 percent of the AUs would occupy an area within immediate proximity to each other in two adjacent drainage basins, increasing their risk from catastrophic events (such as wildfire). The distribution of the AUs in the future could possibly be adequate to support representation and redundancy for the species, if a sufficient number of AUs were projected to be resilient. However, AUs that are not resilient cannot reliably contribute to redundancy or representation, and only two to three of the eight AUs are considered resilient. Further, the redundancy and representation of the species is diminished based on the projected future condition of the AUs, and the potential impacts from wildfire, additional impacts from climate change, water loss due to anthropogenic factors (e.g., surface water diversion and groundwater pumping), and the demographic impacts from these risk factors, as well as the inability to rely on conservation measures. Redundancy is reduced because threats could potentially affect multiple AUs across the range of the headwater chub over the next 30 years and several of these AUs are projected to have diminished resiliency. Consequently, the ability of the species to withstand catastrophic events will likely be impaired.

The significance of isolation in shaping each population highlights the importance of maintaining each independently to preserve the unique genetic variation (Dowling et al. 2008, p. 2). Maintaining representation in the form of genetic or ecological diversity is important to retaining the capacity of the headwater chub to adapt to future environmental changes. The loss of an AU could result in reduced representation due to a loss of genetic diversity. Representation is projected to be reduced because the loss of AUs results in a decrease in the unique genetic management units.

Because this estimate of the condition and distribution of populations in the foreseeable future would not provide sufficient resiliency, representation, and redundancy for the species, the risk of extinction is sufficiently high in the foreseeable future to meet the definition of a threatened species under the Act. We conclude that the headwater chub meets the definition of a threatened species under the Act.

Significant Portion of Its Range for Headwater Chub

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 headwater chub is threatened 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).

Lower Colorado River Basin Roundtail Chub DPS Determination

Endangered Species Throughout Range

I. Standard

Under the Act, an endangered species is any species that is "in danger of extinction throughout all or a significant portion of its range." Because of the fact-specific nature of listing determinations, there is no single metric for determining if a species is currently in danger of extinction. We used the best available scientific and commercial data to evaluate the viability (and thus risk of extinction) for the lower Colorado River basin roundtail chub DPS to determine if it meets the definition of an endangered species. In this determination, we used a description of the condition of populations to describe the viability of the lower Colorado River basin roundtail chub DPS and then determine the DPS's status under the Act.

II. Evaluation

To assist us in evaluating the status of the DPS, we evaluated the risk factors that we found may have potential population-level effects now. This included nonnative aquatic species, water availability, and chub population structure, which we assessed in our model. In addition, this included current risk from wildfire, climate change, water loss due to anthropogenic actions, and demographic effects from these risks factors, as well as the reduction in range. However, these were not analyzed in the model. All of these factors affect the resiliency of AUs for the lower Colorado River basin roundtail chub DPS.

For roundtail chub in the lower Colorado River basin, at least 43 percent of the historical range remains and no more than a 57 percent of the range has been reduced from the historic range. Nonnative aquatic species occupy almost all currently occupied chub streams, and we analyzed impacts to these streams and AUs through the model. Nonnative aquatic species and

chubs have coexisted for some time in several of these streams, but the reasons for this are unclear. There are three streams occupied by the lower Colorado River basin roundtail chub DPS that are currently free of nonnative aquatic species into which nonnatives could expand or be introduced.

In the model, we analyzed the stream length as a measure of water availability. This provided a current condition of the amount of water in a stream at the driest time of year. This captured climate change and anthropogenic actions (surface water diversions and groundwater pumping) impacts to the stream. Wildfire is not analyzed in the model, but we did consider impacts from wildfire. Currently, wildfire could occur almost anywhere within the range of the DPS and impact one or more streams or entire AUs. However, impacts to the lower Colorado River basin roundtail chub DPS are dependent on the severity, location, and timing of the fire, as well as the size of the stream.

Since roundtail chub developed as a result of multiple independent hybridization events over time (Rinne 1976; Rosenfeld and Wilkinson 1989; DeMarais et al. 1992; Dowling and DeMarais 1993; Minckley and DeMarais 2000; Gerber et al. 2001; Schwemm 2006; Schönhuth et al. 2014), it is important to maintain the DPS independently to preserve the unique genetic variation (Dowling et al. 2008, p. 2). The genetic diversity of the lower Colorado River basin roundtail chub DPS is within populations, meaning there is more similarity between populations across its range and connectivity among AUs may be more of an issue.

There is a moderate to high level of uncertainty regarding the newly established populations of roundtail chub in the lower Colorado River basin. Of the four newly established populations of roundtail chub in the lower Colorado River basin, only one, Blue River, has demonstrated reproduction. This could be related to the size of the site, as Blue River is much larger than the other three sites, but this is not clear.

The renovation effort in Fossil Creek for roundtail chub in the lower Colorado River basin (and headwater chub) has proven successful, but such an effort requires a large commitment of resources including funding and personnel.

III. Finding for Lower Colorado River Basin Roundtail Chub DPS

Our review found that 15 AUs currently exist within the historical range of the lower Colorado River basin roundtail chub DPS across five drainage basins. To assess the current condition of these populations, we analyzed the impact from nonnative aquatic species, loss of water, and chub population structure. In addition, we considered wildfire, additional impacts from climate change, and demographic impacts from these factors, as well as reduction in range. We defined the minor risk category as a 0 to 5 percent current chance of extirpation, the low risk category as a 6 to 30 percent current risk of extirpation, the moderate risk category as a 31 to 60 percent current risk of extirpation, and the high risk category as greater than 60 percent current risk of extirpation. The model output resulted in one AU as minor risk, seven as low risk, six as moderate risk, and one as high risk.

Eight AUs are projected as currently having minor or low risk of extirpation. This provides the resiliency (greater than 50 percent of the AUs are considered resilient enough to withstand stochastic events), redundancy (the AUs exist across the historical range, although some are small or have large nonnative aquatic species impacts, to withstand catastrophic events), and representation (multiple populations continuing to occur across the range of the DPS to maintain ecological and genetic diversity).

We consider AUs within the minor to low risk categories to have sufficient resiliency at the present time. We consider these resilient because the risks from nonnative aquatic species and water availability, as well as wildfire, climate change, and genetics, are not having population-level effects to multiple AUs at this time. While the majority of streams occupied by chubs have nonnative aquatic species, there is little direct evidence of extirpation or significant population reductions of chubs from nonnative aquatic species currently; however, for Arizona and New Mexico native fish in general, this has been documented. Further, while the mechanism is unknown, currently there are several streams within multiple AUs containing chubs that have maintained populations in the presence of one or more of these nonnative aquatic species.

While impacts from climate change are likely currently impacting chub populations at some scale, these do not appear to be having population-level impacts at this time. Climate model predictions suggest that climate will entail: an increase in the frequency and duration of droughts, alteration in the timing and amount of spring and fall flows due to changes in precipitation, and increased temperatures resulting in increased evaporation. All of these effects

are likely to negatively affect chub populations. However, these projections are for midcentury (around 2046). The current and ongoing threats are not likely to impact all remaining populations significantly in the near term because these risks, such as climate change, move slowly across the landscape. Projected climate change impacts discussed in this proposed rule are at mid-century (~2046) and are likely to exacerbate water loss, reduction in hydrological connectivity, nonnative aquatic species, and species interactions (impacting demographics) is not projected until 2046.

We consider the DPS to have sufficient redundancy and representation, and sufficiently large populations, that the DPS is able to withstand stochastic events. The AUs are currently spread over a large geographical area such that all the AUs are highly unlikely to experience a catastrophic event that would impacts all AUs now. Further, the current range of the DPS includes AUs that represent the known diversity of ecological settings and genetic materials for the roundtail chub in the lower Colorado River basin . The current and ongoing threats are not likely to impact all remaining populations significantly in the near term because these risks, such as climate change, move slowly across the landscape, and demographic impacts take time to impact a population. The increase or spread of nonnative aquatic species moves faster than climate change or demographics, but it will likely take a few years for a nonnative aquatic species to expand in a currently occupied stream or become established in a new stream. Wildfire is likely to have immediate impacts, but it is highly unlikely that wildfire will impact all AUs at the current time. As a result, it is unlikely that a single stochastic event (e.g., drought, wildfire) or catastrophic event will affect all known extant populations equally or simultaneously now; therefore, it would require several stochastic events or catastrophic events over a number of

years to bring the roundtail chub in the lower Colorado River basin to the brink of extinction due to those factors.

This estimate of the condition and distribution of populations provides sufficient resiliency, representation, and redundancy for the DPS. The primary threats to the DPS (nonnative aquatic species, water availability, and climate change) are not currently having population-level effects to all AUs across the range of the lower Colorado River basin roundtail chub DPS. The threats are not currently impacting multiple populations across the DPS's range. Catastrophic or stochastic events in the present are not likely to have population-level impacts to multiple AUs. Consequently, the risk of extinction is sufficiently low that the DPS does not meet the definition of endangered under the Act. Based on the above information, we conclude that the lower Colorado River basin roundtail chub DPS does not meet the definition of an endangered species under the Act.

Threatened Species Throughout Range

Having found that the lower Colorado River basin roundtail chub DPS is not endangered throughout its range, we next evaluated whether this DPS is threatened throughout its range.

I. Standard

Under the Act, 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." The

foreseeable future refers to the extent to which the Secretary can reasonably rely on predictions about the future in making determinations about the future conservation status of the species (U.S. Department of Interior, Solicitor's Memorandum, M-37021, January 16, 2009). A key statutory difference between an endangered species and a threatened species is the timing of when a species may be in danger of extinction, either now (endangered species) or in the foreseeable future (threatened species). The foreseeable future refers to the extent to which the Secretary can reasonably rely on predictions about the future in making determinations about the future conservation status of the species.

II. Foreseeable Future

To assist us in evaluating the status of the species in the foreseeable future, we evaluated the risk factors that we found may have potential population-level effects over time. This included nonnative aquatic species, water availability, and conservation actions, which we assessed in our model. In addition, we considered the future risk from wildfire, water loss due to future anthropogenic actions, and demographic impacts from these risk factors, as well as reduction in range. In considering the foreseeable future, we forecasted the future status of the lower Colorado River basin roundtail chub DPS as described by the future condition of the AUs. This projected future condition was based on the risk factors and conservation actions affecting the DPS, and the uncertainties associated with these factors and actions. We consider 30 years from now a reasonable time to reliably predict the future conservation status of the DPS.

The best available information indicates that we have a high level of certainty out to 30 years for climate change risks, which is an essential consideration for the foreseeable future. Therefore, our analysis of the status of the DPS to the foreseeable future uses a timeframe of 30 years. The outputs of Jaeger et al.'s (2014, entire) downscaled climate forecasting models project climate scenarios to midcentury (approximately 2050) (IPCC 2014; Jaeger et al. 2014, entire). Jaeger et al. (2014, entire) focuses on the Verde River Basin in Arizona over current (1988-2006) and midcentury (2046-2064) time periods. This study was useful because the lower Colorado River basin roundtail chub DPS occurs in the Verde River Basin and the study focuses on impacts to native fish. Since the potential effects of climate change on flowing regions within streams and connectivity within and among streams, and the exacerbated impacts from nonnative aquatic species and demographics (i.e., age structure and genetics) due to climate change, were primary considerations in our status assessment, we considered climate change predictions essential in the foreseeable future. However, we did not extend our forecasting beyond the midcentury due to uncertainty in the climate change models and in the response of the DPS beyond approximately 2046.

III. Evaluation

To assist us in evaluating the status of the DPS, we evaluated the risk factors that we found may have potential population-level effects over a 30-year time period. This included nonnative aquatic species, water availability, and conservation actions, which we assessed in our model. In addition, we considered the future risk from fire, additional climate change, future anthropogenic actions, and demographic effects from these risks factors, as well as reduction in

range; however, these were not analyzed in the model. We evaluated impacts from these additional risks to each AU and the DPS as a whole.

Chubs are affected not only by the quantity and quality of water, but also by the timing and spatial distribution of water. In the model, we analyzed the reduction in stream length as an impact from climate change. However, climate change models project that over the next 50 years: (1) Future water levels and stream base flows are expected to continue to decrease in the Verde River in the lower Colorado River basin; (2) the frequency of stream drying events in the Verde Valley is expected to increase; (3) the length of the remaining flowing reaches of streams in the Verde Valley (or region) will be reduced; and (4) network-wide hydrologic connectivity for native fishes will be reduced (both over the course of the year and during spring spawning months). Climate change is also projected to alter the timing and amount of snowmelt and monsoon rains, and the frequency and duration of droughts. Climate change will also increase temperature, resulting in increased evaporation. Climate change is also likely to exacerbate water loss, reduction in hydrological connectivity, nonnatives, and species interactions (impacting demographics). All of these factors reduce the resiliency of AUs for the lower Colorado River basin roundtail chub DPS. However, the certainty of the model projections decreases as the projected timeframe increases. Further, the severity of climate change impacts depicted in climate models varies depending on the scenario being evaluated, with some projecting low changes (e.g., increased temperature and decreased rainfall) in carbon dioxide and others projecting high changes. To address this uncertainty, we considered different level of impacts to this DPS under various scenarios. Impacts from climate change are likely to affect all

streams and AUs within the range of the lower Colorado River basin roundtail chub DPS over the next 30 years.

In the model, we analyzed the stream length as a measure of water availability. This provided a current condition of the amount of water in a stream at the driest time of year. This captured climate change and anthropogenic action (surface water diversions and groundwater pumping) impacts to the stream. Wildfire is not analyzed in the model, but we did consider impacts from wildfire. Currently, wildfire could occur almost anywhere within the range of the DPS and impact one or more streams or entire AUs. However, impacts to the lower Colorado River basin roundtail chub DPS are dependent on the severity, location, and timing of the fire, as well as the size of the stream.

As part of the foreseeable future, we also considered the likely reduction in water availability as a result of increased human demand for water, resulting in increased surface water diversions and groundwater pumping. Demand for water is highly likely to increase as human populations are predicted to increase, affecting the timing, amount, and distribution of water within streams. However, population growth, and the exact location of that population growth, is uncertain. Further, the timing and amount of water consumed is uncertain. To address this uncertainty, we considered different levels of impacts to a subset of streams or AUs.

Nonnative aquatic species occupy almost all currently occupied chub streams, and we analyzed impacts to these streams and AUs through the model. Nonnative aquatic species and chubs have coexisted for some time in several of these streams, but the reasons for this are

unclear. We expect that nonnative aquatic species will continue to persist in most if not all of the streams they currently occupy and that nonnative impacts will increase in a percentage of streams across the range of the DPS. In addition, there are three streams occupied by the lower Colorado River basin roundtail chub DPS that are currently free of nonnative aquatic species into which nonnatives could expand or be introduced.

The projected effects to chubs from nonnative aquatic species are likely to be exacerbated by climate change, but this was not analyzed in the model. However, we do consider this in our analysis. As the available watered segments decrease, the interactions between nonnative aquatic species and chubs increase, with more larvae and young-of-the-year removed from the chub populations dues to predation by nonnative aquatic species. In addition, resources become more limited, and the competition for these resources increases. Further, the reduction in water will likely decrease the water quality (e.g., decreased dissolved oxygen, temperature increases, changes in pH, and nutrient loading), which nonnative aquatic species are likely more capable of adapting to than chubs.

Since the lower Colorado River basin roundtail chub DPS developed as a result of multiple independent hybridization events over time (Rinne 1976; Rosenfeld and Wilkinson 1989; DeMarais et al. 1992; Dowling and DeMarais 1993; Minckley and DeMarais 2000; Gerber et al. 2001; Schwemm 2006; Schönhuth et al. 2014), it is important to maintain the DPS independently to preserve the unique genetic variation (Dowling et al. 2008, p. 2). For the lower Colorado River basin roundtail chub DPS, the pattern of more similarity between populations across its range and connectivity among AUs may be more of an issue.

We have a moderate to high level of uncertainty regarding the success of the establishment of new populations. Of the four newly established populations of roundtail chub in the lower Colorado River basin, only one (Blue River) has demonstrated reproduction. One potential factor is the size of the site; Blue River is much larger than the other three sites. The renovation effort in Fossil Creek has proven successful. However, such an effort requires a large commitment of resources including funding and personnel. While attempts at establishing new populations in the future are likely, the success of these sites is uncertain. In addition, the availability of funds and personnel in renovating another site like Fossil Creek is uncertain. Future scenarios projected in our model include conservation actions (establishment of new populations and securing sites), and the uncertainty of success of these sites.

IV. Finding for Lower Colorado River Basin Roundtail Chub DPS

We used the same categories to categorize the risk of extirpation in the foreseeable future (until 2046) as discussed above. We determined that scenarios 1 and 3 are most likely and therefore most useful in making our determination. The model output for scenario 1 projected 17 AUs due to the high management option projects two newly established populations and two renovated sites. The projected risk of extirpation for the 17 AUs were: three AUs in minor risk, seven in low risk, six in moderate risk, and one in high risk of extirpation. Scenario 3 projected: 16 AUs in 2046 due to the low management option only projecting one newly established population. The projected risk of extirpation for the 16 AUs were: two AUs in minor risk, seven in low risk, six in moderate risk, and one in high risk of extirpation.

We consider AUs within the minor to low risk categories to have sufficient resiliency in the future because they contain very few nonnative aquatic species, have long stream length, and have a high chub population structure. All these components increase the AUs' ability to withstand a stochastic event such as wildfire and weather, which are the other risks we considered in our assessment. However, in scenario 1, two of the three AUs in the minor risk category are newly established sites. In scenario 3, one of the two AUs in the minor risk category was a newly established site.

Nonnative aquatic species occur in all but three streams that the lower Colorado River basin roundtail chub DPS occupies. While chubs coexist with nonnative aquatic species in several streams, this does not mean that nonnatives are not impacting chubs. Further, climate change is likely to exacerbate water loss, reduction in hydrological connectivity, nonnative aquatic species, and species interactions (impacting demographics), resulting in increased competition from and predation by nonnatives. Since climate change is likely to affect all streams to varying degrees, it is likely that impacts from nonnative aquatic species will increase in a portion of streams throughout the range of the lower Colorado River basin roundtail chub DPS. The level of increased impacts from nonnative aquatic species is dependent on the condition of the chubs and nonnatives in that AU, and the level of impacts from climate change.

The occurrence of wildfire within the range of the lower Colorado River basin roundtail chub DPS is highly likely. However, the severity, location, and impacts to chubs are uncertain. Over a 30-year period, multiple wildfires could impact multiple AUs. Impacts could range from

loss of individuals to loss of streams to loss of AUs. Demand for water is highly likely to increase as human populations are predicted to increase, affecting the timing, amount, and distribution of water within streams. In addition, the synergistic impacts from the increased effects from wildfire, additional impacts from climate change, water loss due to anthropogenic actions, and demographic effects from these risks factors increase the likelihood and severity of stochastic impacts across the range of the DPS.

This projected number of AUs in moderate and high risk (41 percent) existing across the DPS's range is not considered resilient enough to withstand stochastic events in the foreseeable future. These AUs have moderate to high nonnative aquatic species, low to moderate stream lengths, and low to moderate chub abundance. As stated above, the synergistic impacts from the increased impacts from wildfire, additional impacts from climate change, water loss due to anthropogenic actions, and demographic effects from these risks factors increase the likelihood and severity of stochastic impacts across the range of the DPS. This increase in likelihood and severity increases the risk of extirpation for these AUs in the moderate risk category. Over the 30-year period of the foreseeable future, the risk from demographic (change in age structure and recruitment of populations) and environmental stochasticity (wildfire and weather) may have effects to AUs (or populations) in the moderate risk category. While there are seven AUs that ranked in the low risk category, three of these rank closely to the moderate risk category in scenarios 1 and 3. This leaves three AUs that we consider resilient enough to withstand future stochastic events under the most likely scenarios.

In addition, the model projects that three (38 percent) AUs are isolated and only five (62 percent) AUs have some hydrologic connection. There are projected to be six streams approximately 5 km (3 mi) or less in length. These streams are at a higher risk of extirpation due to stochastic and catastrophic events; the loss of these streams from an AU reduces the resiliency of that AU. Further, there is one AU approximately 5 km (3 mi) or less in length. This AU is at a higher risk of extirpation due to stochastic and catastrophic events. Roundtail chub in the lower Colorado River basin DPS are extirpated from several large riverine streams that provided connectivity across most of the historically occupied range. This has resulted in the recent isolation of AUs even within the same drainage basin. Nine AUs (about 60 percent) are isolated and are not able to naturally recolonize. If a catastrophic event such as wildfire or severe drought occurs within the range of these nine populations, they could be extirpated.

The distribution of the AUs in the future could possibly be adequate to support representation and redundancy for the DPS, if a sufficient number of AUs were projected to be resilient. However, AUs that are not resilient cannot reliably contribute to redundancy or representation. Further, the redundancy and representation of the DPS is diminished based on the projected future condition of the AUs, and the potential impacts from wildfire, additional impacts from climate change, and water loss due to anthropogenic factors (e.g., surface water diversion and groundwater pumping), the demographic impacts from these factors, and the inability to rely on conservation measures. Redundancy is reduced because threats could potentially affect multiple AUs across the range of the lower Colorado River basin roundtail chub DPS over the next 30 years and several of these AUs are projected to have diminished resiliency. Consequently, the ability of the DPS to withstand catastrophic events is impaired.

Historically, the lower Colorado River basin roundtail chub DPS had greater connectivity. Maintaining representation in the form of genetic or ecological diversity is important to keep the capacity of the chub to adapt to future environmental changes. The loss of an AU could result in reduced representation due to a loss of genetic diversity. Representation for the lower Colorado River basin roundtail chub DPS is projected to be reduced because of the further reduction in connectivity among streams.

Because this estimate of the condition and distribution of populations in the foreseeable future would not provide sufficient resiliency, representation, and redundancy for the DPS, the risk of extinction is sufficiently high in the foreseeable future to meet the definition of a threatened species under the Act. We conclude that the lower Colorado River basin roundtail chub DPS meets the definition of a threatened species under the Act.

Significant Portion of Its Range

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 lower Colorado River basin roundtail chub DPS is threatened 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).

Critical Habitat

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.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical and biological features within an area, we focus on the principal biological or physical constituent elements (primary constituent elements such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that are essential to the conservation of the species. Primary constituent elements are those specific elements of the

physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species.

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in 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. For example, an area currently occupied by the species but that was not occupied at the time of listing may be essential to the conservation of the species and may be included in the critical habitat designation. We designate critical habitat in areas outside the geographical area occupied by a species only when a designation limited to its range would be inadequate to ensure the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific and commercial 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.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include the recovery plan for the species, articles in peer-reviewed journals, conservation plans developed by States and counties, scientific status surveys and studies, biological assessments, other unpublished materials, or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act, (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species, and (3) section 9 of the Act's prohibitions on taking any individual of the species, including taking caused by actions that affect habitat. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of this species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, habitat conservation plans (HCPs), or other

species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

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 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 either the headwater chub or the lower Colorado River basin roundtail chub DPS, and identification and mapping of critical habitat is not expected to initiate 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. Here, 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 the species/DPS and may provide some measure of benefit, we find that designation of critical habitat is prudent for both the headwater chub and lower Colorado River basin roundtail chub DPS.

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 headwater chub or lower Colorado River basin roundtail chub DPS 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) Information sufficient to perform required analyses of the impacts of the designation is lacking, or

(ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.

Delineation of critical habitat requires, within the geographical area occupied by the headwater chub or lower Colorado River basin roundtail chub DPS**,** identification of the physical or biological features essential to the conservation of the species. A careful analysis of the areas that may have the physical or biological features essential for the conservation of the species and that may require special management considerations or protections, and thus qualify for designation as critical habitat, will require a thorough assessment. Additionally, critical

habitat can include specific areas outside the geographical area occupied by the species that are determined to be essential to its conservation. While we have some information on the habitat requirements of the species, the analysis of which of the specific features and areas meet the definition of critical habitat has not been completed. Since we have not determined which specific areas may meet the definition of critical habitat, the information sufficient to perform the required analysis of impacts of the critical habitat designation is lacking. Accordingly, we find designation of critical habitat to be "not determinable" at this time. When critical habitat is not determinable, the Act allows the Service an additional year to publish a proposed critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)).

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened 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 Arizona Ecological Services 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 the headwater chub and the lower Colorado River basin roundtail chub DPS are 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 Arizona and New Mexico would be eligible for Federal funds to implement management actions that promote the protection or recovery of the headwater chub and lower Colorado River basin roundtail chub DPS. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants*.

Although the headwater chub and lower Colorado River basin roundtail chub DPS are 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 land management and any other landscape-altering activities on Federal lands administered by the U.S. Forest Service, Bureau of Land Management, 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; Bureau of Reclamation activities; and construction and maintenance of roads or highways by the Federal Highway Administration.

Under section 4(d) of the Act, the Service has discretion to issue regulations that we find necessary and advisable to provide for the conservation of threatened wildlife. We may also prohibit by regulation with respect to threatened wildlife any act prohibited by section 9(a)(1) of the Act for endangered wildlife. For the headwater chub and lower Colorado River basin roundtail chub DPS, we are requesting information as to which prohibitions, and exceptions to

those prohibitions, are necessary and advisable to provide for the conservation of the headwater chub or the lower Colorado River basin roundtail chub DPS pursuant to section 4(d) of the Act

We may issue permits to carry out otherwise prohibited activities 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, for the enhancement of propagation or survival, for economic hardship, for zoological exhibition, for educational purposes, 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 species proposed for listing. Based on the best available information, 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.

(2) Recreational activities such as sightseeing, hiking, camping, and hunting in the vicinity of headwater chub or lower Colorado River basin roundtail chub DPS populations that do not destroy or significantly degrade their habitats, and do not result in take of headwater chub or roundtail chub.

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

(1) Unauthorized collecting or handling of headwater chub or lower Colorado River basin roundtail chub DPS;

(2) Use of piscicides, pesticides, or herbicides in violation of label restrictions;

(3) Introduction of nonnative fish that compete with or prey upon headwater chub or lower Colorado River basin roundtail chub DPS;

(4) Modification of the channel or water flow of any stream or removal or destruction of emergent aquatic vegetation in any body of water in which the headwater chub or lower Colorado River basin roundtail chub DPS is known to occur;

(5) Destruction or alteration of riparian and adjoining uplands of waters supporting headwater chub or lower Colorado River basin roundtail chub DPS by timber harvest, poor livestock grazing practices, road development or maintenance, or other activities that result in the destruction or significant degradation of cover, channel stability, substrate composition, increased turbidity, or temperature that results in death of or injury to any life-history stage of headwater chub or lower Colorado River basin roundtail chub DPS through impairment of the species' essential breeding, foraging, sheltering, or other essential life functions; and

(6) Release of biological control agents that attack any life stage of headwater chub or lower Colorado River basin roundtail chub DPS.

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

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 the **ADDRESSES** section. 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).

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.

We have determined that there are tribal lands that are occupied by headwater chub or lower Colorado River basin roundtail chub DPS. The lands owned by San Carlos Apache Tribe and White Mountain Apache Tribe contain the largest amount of occupied streams. We have begun government-to-government coordination with these tribes. We sent notification letters in July 2014 to each tribe informing them of our assessment of the species under section 4(b)(2) of the Act. We have engaged in conversations with both tribes about the status assessment. We met with the White Mountain Apache Tribe on September 24, 2014, which Chairman Lupe attended, and had a follow-up call with tribal representatives on October 23, 2014. We met with the Recreation and Wildlife Director of the San Carlos Apache Tribe on July 30, 2014. We also sent letters to the following tribes that may be affected by the proposed listing or future proposed critical habitat: Ak-Chin Indian Community, Chemehuevi Tribe, Colorado River Indian Tribes, Fort McDowell Yavapai Nation, Gila River Indian Community, Hopi Tribe, Hualapai Tribe, Navajo Nation, Pascua Yaqui Tribe, Salt River Pima-Maricopa Indian Community, Tonto Apache Tribe, Yavapai Apache Nation, Yavapai-Prescott Indian Tribe, and Zuni Pueblo. We will continue coordinating with these tribes and any other interested tribes.

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 Arizona Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the Arizona Ecological Services 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—[AMENDED]

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 entries for “Chub, headwater” and “Chub, roundtail” in alphabetical order under FISHES to the List of Endangered and Threatened Wildlife in to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic Range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	**Scientific name**						
* * * * * * *							
FISHES							
* * * * * * *							
Chub, headwater	*Gila nigra*	U.S.A. (AZ, NM)	Entire	T		NA	NA
* * * * * * *							

Chub, roundtail	*Gila robusta*	U.S.A. (AZ, CO, NM)	The Lower Colorado River and its tributaries downstream of Glen Canyon Dam, including the Gila and Zuni River basins in New Mexico	T	NA	NA

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Dated**:** September 18, 2015

Signed: Stephen Guertin

Acting Director, U.S. Fish and Wildlife Service

Billing Code 4310–55–P

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