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Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Zuni Bluehead Sucker; Final Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2012–0101; 4500030113]

RIN 1018–AY25

Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Zuni Bluehead Sucker

AGENCY: Fish and Wildlife Service, Interior.

AGENCY: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine endangered species status under the Endangered Species Act of 1973 (Act), as amended, for the Zuni bluehead sucker (*Catostomus discobolus yarrowi*), a fish species from Arizona and New Mexico. The effect of this regulation will be to add this species to the List of Endangered and Threatened Wildlife.

DATES: This rule becomes effective August 25, 2014.

ADDRESSES: This final rule is available on the Internet at *http://www.regulations.gov* and on the New Mexico Ecological Service Field Office Web site at *http://www.fws.gov/southwest/es/newmexico.* Comments and materials we received, as well as supporting documentation we used in preparing this rule, are available for public inspection at *http://www.regulations.gov.* All of the comments, materials, and documentation that we considered in this rulemaking are available by appointment, during normal business hours at: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, 2105 Osuna NE., Albuquerque, NM 87113; telephone 505–346–2525; facsimile 505–346–2542.

FOR FURTHER INFORMATION CONTACT: Wally ''J'' Murphy, Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, 2105 Osuna NE., Albuquerque, NM 87113, by telephone 505–346–2525 or by facsimile 505–346–2542. 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, a species may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can be completed only by issuing a rule.

This rule will finalize the listing of the Zuni bluehead sucker *(Catostomus discobolus yarrowi)* as an endangered species.

The Endangered Species Act provides the basis for our action. Under the Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

We have determined that the Zuni bluehead sucker meets the definition of an endangered species due to the combined effects of:

- Habitat destruction, modification, and degradation resulting from water withdrawal (stream drying); sedimentation; impoundments; livestock grazing; and the spread of nonnative species.
- Predation by nonnative species such as the green sunfish *(Lepomis cyanellus),* northern crayfish *(Orconectes virilis),* and red swamp crayfish *(Procambarus clarkii),* which limit recruitment and reduce population size.
- Existing Federal, State, or Tribal regulatory mechanisms that could provide protection to the Zuni bluehead sucker do provide limited protection; however, many are inadequate to protect the species from existing and future threats.
- Small population size and restricted ranges of the species make the Zuni bluehead sucker population vulnerable to stochastic events, such as wildfire and drought.

We requested peer review of the methods used in making our final determination. We obtained opinions from five knowledgeable individuals having scientific expertise in this species and solicited review of the scientific information and methods that we used in developing the proposal. During the public comment period following the 6-month extension notice, we also obtained opinions and information from three knowledgeable individuals with genetic and morphological expertise. These individuals reviewed all available relevant information for the Zuni bluehead sucker to determine whether we had used the best available information. These peer reviewers generally concurred with our methods and conclusion, and provided additional information, clarification, and suggestions to improve this final listing rule.

We sought public comment on the proposed listing rule. During the first comment period, we received four comment letters directly addressing the proposed listing. During the second comment period, we received six comment letters addressing the proposed listing rule.

Previous Federal Action

We first identified the Zuni bluehead sucker as a candidate species in the September 18, 1985, Review of Vertebrate Wildlife; Notice of Review (50 FR 37958). The Zuni bluehead sucker was identified as a Category 2 Candidate species at that time; Category 2 Candidates were defined as species for which we had information that proposed listing was possibly appropriate, but conclusive data on biological vulnerability and threats were not available to support a proposed rule at the time. The species remained so designated in subsequent annual Candidate Notices of Review (CNOR) (54 FR 554, January 6, 1989; 56 FR 58804, November 21, 1991; and 59 FR 58982, November 15, 1994). In the February 28, 1996, CNOR (61 FR 7596), we discontinued the designation of Category 2 species as candidates; therefore, the Zuni bluehead sucker was no longer a candidate species.

Subsequently, in 2001, the Zuni bluehead sucker was added to the candidate list (66 FR 54807, October 30, 2001). Candidates are those fish, wildlife, and plants for which we have on file sufficient information on biological vulnerability and threats to support preparation of a listing proposal, but for which development of a listing regulation is precluded by other higher priority listing activities. The Zuni bluehead sucker was included in all of our subsequent annual CNORs (67 FR 40657, June 13, 2002; 69 FR 24876, May 4, 2004; 70 FR 24870, May 11, 2005; 71 FR 53756, September 12, 2006; 72 FR 69034, December 6, 2007; 73 FR 75176, December 10, 2008; 74 FR 578034 November 9, 2009; 75 FR 69222, November 10, 2010; and 76 FR 66370, October 26, 2011). On May 11, 2004, we were petitioned to list Zuni bluehead sucker, although no new information was provided in the petition. Because we had already found that the species warranted proposed listing, no further action was taken on the petition. Zuni bluehead sucker has a listing priority number of 3, which reflects a subspecies with threats that are both imminent and high in magnitude.

On January 25, 2013, we published in the **Federal Register** a proposed rule (78 FR 5369) to list the Zuni bluehead sucker as an endangered species under the Act. On the same date, we also published in the **Federal Register** a proposed rule to designate critical habitat for the Zuni bluehead sucker (78 FR 5351; January 25, 2013). Both the proposed listing rule and the proposed critical habitat rule had a 60-day comment period, ending March 26, 2013.

After the publication of the proposed rules, we found there was substantial scientific disagreement regarding the taxonomic status of some populations that we considered Zuni bluehead sucker in the proposed rule, and we reopened the comment period for the proposed listing rule and extended the schedule for the final determination for 6 months in order to solicit and analyze information that would help to clarify the issues. On January 9, 2014, we published in the **Federal Register** a notice that extended the final determination for the Zuni bluehead sucker by 6 months due to substantial disagreement regarding the Zuni bluehead sucker's taxonomic status in some locations (79 FR 1615). That comment period closed on February 10, 2014.

Background

Species Information

The Zuni bluehead sucker has a fusiform (torpedo-shaped), slender body with a subterminal mouth (mouth posterior to the tip of the snout) (Propst 1999, p. 49). Most individuals do not exceed 20.3 centimeters (cm) (8 inches (in)) in total length, although the species has been known to exceed 25 cm (9 in) in total length (Propst and Hobbes 1996, pp. 22–34). The Zuni bluehead sucker has a bluish head, silvery-tan to dark green back, and yellowish to silvery-white sides and abdomen. Adults are mottled slate-gray to almost black dorsally (upper part of the body) and cream-white ventrally (toward the abdomen). During the spawning season, males may be differentiated by coarse tubercles (wart-like projections) on the rear fins and the caudal peduncle (the narrow part of the fish's body to which the tail fin is attached). Males also have distinctive breeding coloration, becoming intensely black dorsally with a bright red horizontal band and a white abdomen (Propst 1999, p. 49; Propst *et al.* 2001, p. 163).

Habitat and Life History

Carman (2008, p. 2) described Zuni bluehead sucker habitat as stream reaches with clean, perennial water flowing over hard substrate (material on the stream bottom), such as bedrock. Propst and Hobbes (1996, pp. 13, 16) reported that Zuni bluehead suckers were collected mainly in pool and pool-run habitats. These habitat areas were shaded with water velocities of less than 0.1 meter per second (0.3 feet per second) (Propst and Hobbes 1996, p. 13). Most specimens were found in water that was 30 to 50 cm (12 to 20 in) deep with cobble, boulders, and bedrock substrate (Propst and Hobbes 1996, pp. 13, 16). In general, Zuni bluehead sucker was rare or absent in reaches where the substrate was dominated by silt or sand (New Mexico Department of Game and Fish (NMDGF) 2004, p. 7). Pools were often edged by emergent aquatic plants and riparian vegetation (mainly willows (*Salix* spp.)) (Propst and Hobbes 1996, p. 16).

Zuni bluehead sucker feed primarily on algae scraped from rocks, rubble, and gravel substrates (Winter 1979, p. 4; Sublette *et al.* 1990, p. 211). Algae attached to rocks and plants are generally abundant in reaches where Zuni bluehead suckers are common (NMDGF 2004, p. 8). Bluehead suckers, including the Zuni bluehead sucker, require clean gravel substrate with minimal silt for spawning (Maddux and Kepner 1988, p. 364) because silt covers eggs and leads to suffocation.

Taxonomy and Genetics

To help understand the information that follows in this ''Taxonomy and Genetics'' section and throughout the entirety of this final rule, we provide a geographic introduction to orient the reader. There are three main areas discussed in this final rule: The Zuni River watershed, the Kinlichee Creek watershed, and the Canyon de Chelly watershed. The Zuni River watershed of the Little Colorado River watershed in New Mexico contains the following streams: Zuni River, Rio Pescado, Rio Nutria, Tampico Draw, and Cebolla Creek. In addition, there are two headwater springs to the Rio Nutria; these are Tampico Spring (formerly known as Deans Creek) and Agua Remora (formerly known as Radosevich Creek). The Kinlichee Creek watershed occurs in eastern Arizona on the Navajo Nation near Ft. Defiance and is part of the Little Colorado River watershed. Streams in this watershed include Red Clay Wash, Black Soil Wash, Scattered Willow Wash, and Kinlichee Creek itself. Lastly, the Canyon de Chelly watershed occurs on the Navajo Nation in the Lower San Juan River watershed located in northeastern Arizona and northwestern New Mexico, and includes the following streams: Tsaile Creek, Sonsela Creek, Wheatfields Creek, Whiskey Creek, Coyote Wash, Little Whiskey Creek, and Crystal Creek. Most of the Canyon de Chelly watershed is not discussed in depth in this final rule because the best available information does not support a determination that Zuni bluehead sucker occurs in the Canyon de Chelly watershed; however, this is explained in more detail below and in the Summary of Comments and Recommendations section. A geographical reference map is available on *http://www.regulations.gov* and on the New Mexico Ecological Services Field Office Web site at *http://www.fws.gov/southwest/es/NewMexico/*. In addition, Table 1 (below) outlines where the various streams discussed in this rule occur.

TABLE 1—GEOGRAPHICAL REFERENCE INFORMATION REGARDING WATERSHEDS DISCUSSED IN FINAL LISTING RULE

Subwatershed	State	Watershed	Streams
Zuni River	New Mexico	Little Colorado River	Zuni River, Rio Pescado, Rio Nutria, Tampico Draw, Cebolla Creek, Tampico Spring, Agua Remora.
Kinlichee Creek	Arizona	Little Colorado River	Red Clay Wash, Black Soil Wash, Scattered Willow Wash, Kinlichee Creek.
Canyon de Chelly	Arizona & New Mexico	Lower San Juan River	Tsaile Creek, Sonsela Creek, Wheatfields Creek, Whiskey Creek, Coyote Wash, Little Whiskey Creek, and Crystal Creek.

The 6-month extension notice (79 FR 1615, January 9, 2014) included a detailed discussion of the taxonomy and genetics of the Zuni bluehead sucker. Rather than repeating that information here, we have narrowed our discussion in this final rule to address information from public comments received since the time of the proposed listing rule and to explain our overall conclusions.

Our evaluation of morphological (pertaining to the physical form and structure of the fish) and genetic information supports recognition of the Zuni bluehead sucker as being a valid subspecies distinct from both the Rio Grande sucker (*Catostomus plebeius*) and the bluehead sucker (*C. discobolus*) (Smith 1966, pp. 87–90; Smith *et al.* 1983, pp. 37–38; Crabtree and Buth 1987, p. 843; Propst 1999, p. 49). The Zuni bluehead sucker subspecies likely originated from a prehistoric geological event in which water of a Rio Grande tributary (where the Rio Grande sucker occurred) were brought into the headwaters of a Little Colorado River tributary (where the bluehead sucker occurred); this event caused the Rio Grande sucker and the bluehead sucker (which were formerly geographically isolated from one another) to come into contact and begin exchanging genes during the late Pleistocene (more than 1.1 million years ago) (Smith 1966, pp. 87–90; Smith *et al.* 1983, pp. 37–38; Unmack *et al.* 2014, p. 12). This process of the movement of a gene from one species into the gene pool of another species is known as introgression. Introgression results in a complex mixture of the parental genes in the offspring. In the case of the Zuni bluehead sucker, this genetic mixing of Rio Grande sucker genes with bluehead sucker genes occurred over an unknown length of time and created the distinct subspecies.

As a result of this introgression, the best scientific information available indicates that the Zuni bluehead sucker subspecies exhibits either morphological or genetic traits that trace their ancestry to both bluehead sucker and Rio Grande sucker, with these traits randomly distributed in the population. The Zuni bluehead sucker subspecies is comprised of a complex of populations that may contain a subset of morphological or genetic traits as described above, but these populations (in the various watersheds) can be quite distinct from each other because all populations do not contain all morphological or genetic traits which resulted from the introgression. These morphological traits include several physical characteristics that are different from other bluehead suckers or Rio Grande suckers (such as fin-ray, lip, and jaw characteristics). These morphological traits are discussed in more detail in Smith *et al.* (1983, pp. 46–47). The populations described below in the ''Range and Distribution'' section all have at least one or both morphological or genetic traits that provide evidence and confirm that these populations are in fact Zuni bluehead sucker. If in the future, new information becomes available that indicates a population is confirmed to be Zuni bluehead sucker, that population would be considered part of the listed Zuni bluehead sucker entity and, thus, be protected under the Act.

Both morphological and genetic data demonstrates that the Zuni bluehead sucker is present in the Zuni River watershed. However, the taxonomy of the occurrences of the subspecies outside of the Zuni River watershed has been disputed. Studies by Smith *et al.* (1983, entire) and Crabtree and Buth (1987, entire) support their conclusion that Zuni bluehead sucker occurs in both the Kinlichee Creek watershed of eastern Arizona and the Zuni River watershed in New Mexico. Alternatively, the Schwemm and Dowling (2008, entire) analysis extended the geographical range of the Zuni bluehead sucker to include bluehead suckers in the Lower San Juan River watershed (specifically in the Canyon de Chelly watershed, as discussed in the proposed rule). Lastly, Hopken *et al.* (2013, pp. 958, 966) and Douglas *et al.* (2013, pp. 2–3) provided evidence that the Zuni bluehead sucker occurred only in the Zuni River watershed (and not in the Kinlichee Creek watershed or the Canyon de Chelly watershed). These studies provided comprehensive data on the genetic variation across the range of the species, and we use these studies to evaluate which populations contain morphological or genetic evidence to support recognition as Zuni bluehead suckers. We also reviewed other relevant information (such as fisheries management in the Zuni River watershed) to contribute to our interpretation of the above-mentioned studies.

Initially, the proposed rule described the Zuni bluehead sucker subspecies as including the bluehead sucker populations from Canyon de Chelly because nuclear DNA (nDNA) analysis by Schwemm and Dowling (2008, p. 12) reported the presence of Rio Grande sucker genetics, providing new evidence that introgression of Rio Grande sucker with bluehead sucker expanded beyond the Little Colorado River watershed into the Lower San Juan River watershed. However, since the publication of the proposed rule, we received peer review comments from Dowling (2014, entire) that re-evaluated and summarized Schwemm and Dowling (2008, entire). Schwemm and Dowling (2008, entire) and Dowling (2014, entire) are, therefore, referred to as the same study. Dowling (2014, p. 2) stated that an error was recently discovered in the genetic data of Schwemm and Dowling (2008, entire). This error provides evidence that the bluehead suckers in the Lower San Juan River watershed (Canyon de Chelly watershed) should not currently be definitively recognized as Zuni bluehead sucker because the nDNA analysis was determined to be inaccurate. There is no other morphological or genetic evidence to support that the Zuni bluehead sucker occurs in the Canyon de Chelly populations; these populations do not exhibit evidence of either a genetic signature of the Rio Grande sucker or unique Zuni bluehead sucker genetics. Thus, the Canyon de Chelly populations will no longer be discussed in this final listing rule. The Canyon de Chelly populations are bluehead suckers but are not part of the Zuni bluehead sucker subspecies' range based on both literature and peer review comments received during the open comment period of the 6-month extension.

Similarly, the taxonomy of the occurrences of the Zuni bluehead sucker subspecies in the Kinlichee Creek watershed has also been disputed. The error that Dowling (2014, p. 2) described in the genetic data of Schwemm and Dowling (2008, entire) also discounts that introgression between the Rio Grande sucker and bluehead sucker established the Zuni bluehead sucker subspecies in the Kinlichee Creek watershed. Specifically, Dowling (2014, p. 5) states that there is no genetic evidence of the Rio Grande sucker in the specimens sampled from the Kinlichee Creek watershed. However, despite a lack of genetic evidence to support this conclusion, Smith *et al.* (1983, entire) provides morphological evidence supporting that introgression between the two species likely did establish the Zuni bluehead sucker subspecies in the Kinlichee Creek watershed. Some of the physical attributes evaluated by Smith *et al.* (1983, entire) include width of the specimen's jaw, standard length, and tail length; all of these attributes are consistent with the hypothesis of introgression between Rio Grande suckers and bluehead suckers. Thus, Dowling (2014, p. 5) concludes that Kinlichee Creek should be identified as part of the Zuni bluehead sucker range

based on the morphological evidence. In addition to the morphological evidence of Smith *et al.* and emphasized by Dowling, Crabtree and Buth (1987, pp. 848, Table 2, 852) concluded that specimens in the upper Little Colorado River watershed, where Kinlichee Creek is located, contained genetics unique to the Zuni bluehead sucker. This further supports that Zuni bluehead sucker likely occurs in the Kinlichee Creek watershed.

The two studies that discount the presence of Zuni bluehead sucker in the Kinlichee Creek watershed are Hopken *et al.* (2013, entire) and Douglas *et al.* (2013, entire). However, Hopken *et al.* (2013, entire) did not evaluate samples from this watershed. Alternatively, Douglas *et al.* (2013, entire) evaluated samples from the Kinlichee Creek watershed and failed to detect Rio Grande sucker genetics in the specimens sampled. The lack of the Rio Grande sucker genetic signature in Kinlichee Creek may be due to genetic bottlenecks. A genetic bottleneck is an event during which only a few individuals survive to continue the existence of the population; these bottlenecks result in a loss of genetic diversity and a loss of especially rare genetics such as those that may be in a Rio Grande sucker or the Zuni bluehead sucker itself. The Kinlichee Creek watershed is geographically isolated from the Zuni River watershed population, and, within the Kinlichee Creek watershed, the population faces periodic fragmentation that can limit gene flow and contribute to genetic bottlenecks. Thus, Douglas *et al.* (2013, p. 15) concluded that several populations within the Kinlichee Creek watershed have experienced genetic bottlenecks at some point in time. Furthermore, although the genetic analysis did not find the presence of the Rio Grande sucker genetics in specimens from Kinlichee Creek, the specimens throughout the Little Colorado River watershed sampled by Crabtree and Buth (1987, pp. 848, Table 2, 852) contained genetics unique to the Zuni bluehead sucker as described above. Based on the morphological evidence and the presence of unique Zuni bluehead sucker genetics in some sites within the watershed, we conclude that the streams we have described as the Kinlichee Creek area should be identified as part of the Zuni bluehead sucker subspecies' range. Given the information and rationale explained above, we conclude that the Zuni bluehead sucker currently occurs in two discrete watersheds—the Zuni River watershed and the Kinlichee Creek watershed.

There are also genetic issues for the subspecies located within the Zuni River watershed. It is important to note that the Agua Remora population was established by a translocation effort made by the Radosevich family in the 1920s (Winter 1979, p. 4) or 1930s (Merkel 1979, p. 11). An unknown number of Zuni bluehead sucker were translocated from the Rio Nutria to Agua Remora (Merkel 1979, p. 11), and it is also unknown if this was a single or multiple translocation events. Then, beginning in the 1960s and ending in 1975, a series of chemical treatments were initiated in both the Rio Nutria and Rio Pescado to eradicate several species of fish that were problematic for the establishment of rainbow trout (*Oncorhynchus mykiss*) populations in the reservoirs connected to the Rio Nutria on the Zuni Indian Reservation (Merkel 1979, entire). Although these treatments did not include Agua Remora because it was on private land, one of the species eradicated by these chemical treatments was the Zuni bluehead sucker, which was not present in the post-treatment surveys conducted, including within the Nutria Box (chemically treated in 1960, 1962, and 1967) (Merkel 1979, p. 13). Later, during a survey in 1971, a sizeable population of Zuni bluehead sucker was found within and below the Nutria Box, and Merkel (1979, p. 10) hypothesized that this population was either reestablished with individuals from Agua Remora during high flow events or that the fish were not completely eradicated from the Nutria Box. Further surveys of the upper Rio Nutria watershed in 1972 and 1973 found two populations, one at Agua Remora and another below Nutria Reservoir Number 2 (Merkel 1979, pp. 11–12).

Starting in 1975, a series of translocation events were conducted using fish from Agua Remora (Merkel 1979, p. 15). The new populations included Tampico Draw (100 fry and 15 yearlings), Tampico Spring (50 fry and 10 yearlings), Rio Nutria above Nutria Box (200 fry and 40 yearlings), and Cebolla Creek (Rio Pescado tributary; 250–300 fry and 20 yearlings) (Merkel 1979, p. 15). Many of these populations experienced high post-stocking mortality (40–50 percent) including complete mortality (Tampico Draw and Cebolla Creek). Hanson (1980, p. 13) found a number of populations within the Rio Pescado during surveys conducted in 1978 and confirmed the presence of the Zuni bluehead sucker in Agua Remora and the upper portion of the Rio Nutria, including Nutria Box and Tampico Spring. Based on the known history (i.e., fish translocation), we conclude that the Agua Remora population was founded by a few individuals from Rio Nutria; likewise, the Tampico Spring population was founded by a few individuals from Agua Remora. The genetic analysis from Douglas *et al.* (2013, pp. 13–16), and Schwemm and Dowling (2008, p. 12), indicate that the Rio Nutria population has Rio Grande sucker genetics. Alternatively, genetic analysis by Turner and Wilson (2009, p. 9) failed to identify a Rio Grande sucker genetic signature in Rio Nutria; however, this may be attributed to small sample size (n=25). This lack of genetic signature is likely due to the small number of individuals used to establish the new populations, which can create a genetic bottleneck, as explained above. Both Hopken *et al.* (2013, p. 964) and Douglas *et al.* (2013, p. 15), concluded that the Agua Remora population has experienced genetic bottlenecks at some point in time.

It is believed that the Rio Nutria population was reestablished from individuals from Agua Remora (Merkel 1979, p. 11); however, this is unlikely given the lack of Rio Grande sucker genetics in the Agua Remora population. It is more likely that Zuni bluehead sucker individuals within the Rio Nutria or Nutria Box survived chemical treatment. Thus, historical genetic bottlenecks, especially when followed by genetic drift (elevated random loss of genetics corresponding to physical traits that occurs in small populations), can alter the present genetic signature of a population. The lack of a Rio Grande sucker genetic signature in the Tampico Spring population does not imply these fish are not Zuni bluehead sucker because history shows that these populations were established by translocation efforts. This is consistent with the results from Crabtree and Buth (1987, p. 852) supporting a conclusion that Zuni bluehead sucker is a distinct subspecies regardless of its interaction with Rio Grande sucker.

Range and Distribution

New Mexico Distribution

The Zuni River watershed extends west from the continental divide, across the Zuni Pueblo, and drains into the Little Colorado River in Arizona, west of the Zuni Pueblo. In the Zuni River watershed of New Mexico, as mentioned above, the subspecies is believed to be restricted to three isolated populations in the upper Rio Nutria watershed (Carman 2008, pp. 2–3). More specifically, the subspecies occurs in

and upstream of the Rio Nutria from the mouth of Rio Nutria Box Canyon near the eastern boundary of the Zuni Pueblo, and upstream in Tampico Draw. In addition, Zuni bluehead sucker also occurs in separate populations in two headwater springs to the Rio Nutria: Tampico Spring and Agua Remora (Hanson 1980, p. 1; Propst *et al.* 2001, p. 161). Although there are two Tampico Springs, the Tampico Spring we discuss in this final listing rule is on private land on the west side of the Oso Ridge and is not identified on a topographic map. This should not be confused with another Tampico Spring identified on topographic maps, located on public land, which is on the east side of the Oso Ridge. Elsewhere in the Zuni River watershed, the Zuni bluehead sucker is rare or absent. Flow is intermittent in the Zuni River, Rio Pescado, and Rio Nutria, except for short reaches that flow permanently in response to discharge from springs (Orr 1987, p. 37; NMDGF 2013, p. 9).

Zuni bluehead sucker numbers have been starkly reduced in the Zuni River watershed in New Mexico, largely due to 27 chemical treatments during the 1960s to remove green sunfish and fathead minnow (*Pimephales promelas*) from the Rio Nutria to aid in the establishment of a rainbow trout sport fishery in reservoirs on Zuni Pueblo (Winter 1979, p. 4). These treatments eliminated the Zuni bluehead sucker from most of the Zuni River watershed (Winter 1979, p. 4). As a result, by the late 1970s, the Zuni bluehead sucker range in New Mexico had been reduced. While records are largely incomplete, it is known that a population of Zuni bluehead suckers near the mouth of the Rio Nutria Box Canyon was extirpated due to chemical treatments and that substantial numbers were also eliminated in other reaches of the Rio Nutria and Rio Pescado (NMDGF 2004, p. 16).

The Zuni bluehead sucker has not been collected from the mainstem Zuni River since 1978 or from the Rio Pescado since 1993 (Hanson 1980, pp. 12–13; Propst and Hobbs 1996, pp. 11–12). Much of the lower portions of historical habitat in the Zuni River and Rio Pescado are dry during certain times of the year. Continued monitoring of these streams since 2004 has confirmed the extirpation of the Zuni bluehead sucker from these rivers (NMDGF 2004, p. 4; Carman 2007, p. 1; 2008, p. 1; 2009, p. 1). Additionally, Cebolla Creek, a Zuni River tributary, was surveyed in 1979, and no Zuni bluehead suckers were found, although habitat appeared suitable (Hanson 1980, pp. 29, 34).

The population of Zuni bluehead suckers in the Rio Nutria was maintained by dispersal of individuals from upstream untreated reaches, such as Agua Remora (Winter 1979, p. 4; Propst 1999, pp. 49–50). The Zuni bluehead sucker persists in the upper Rio Nutria watershed in three isolated populations over 3.7 kilometers (km) (2.3 miles (mi)), mainly upstream of the mouth of the Rio Nutria Box Canyon and two springs (Propst 1999, pp. 49–50; Propst *et al.* 2001, p. 168; Carman 2008, pp. 2–3; Service 2014a, pers. comm., entire). Within this watershed, it is most common near the Rio Nutria Box Canyon mouth, the confluence of the Rio Nutria and Tampico Draw, and headwater springs such as Agua Remora and Tampico Spring (Stroh and Propst 1993, p. 34; Propst and Hobbes 1996, p. 10; Propst 1999, p. 50; Propst *et al.* 2001, p. 162; Carman 2007, p. 1; 2008, p. 1; 2009, p. 2; 2010, p. 1; Gilbert and Carman 2011, p. 1; NMDGF 2013, p. 1). Within the 3.7-km (2.3-mi) occupied reach, the largest extent of perennial stream with limited levels of siltation is found in the Rio Nutria Box Canyon, from the confluence with Tampico Draw downstream to the canyon mouth.

Population Status of the Species in New Mexico

Population abundance has not been estimated because of the difficulty of detecting and sampling all habitats. However, results from numerous survey efforts confirm that Zuni bluehead sucker populations in New Mexico are fragmented and low in numbers. Fish surveys have been conducted within the Zuni River watershed in 1977–1979, 1984, 1990–1993, 2000–2001, and every year since 2004 (Winter 1977, p. 1; Hanson 1980, p. 29; Stefferud 1985, p. 1; Propst and Hobbes 1996, p. 14, Carman 2010, pp. 13–15, Gilbert and Carman 2011, p. 23; NMDGF 2013, p. 25). Based on available maps and survey information, we estimate the present range of the Zuni bluehead sucker in New Mexico to be approximately 5 percent or less of its historical range.

The first extensive survey for the Zuni bluehead sucker in the Zuni River watershed was during 1978 and 1979 (Hanson 1980, p. 1). Hanson (1980, pp. 7, 8, 11, 13, 25, 27) provides a detailed map of areas surveyed, which included the following locations: Zuni River, Rio Pescado, Rio Nutria, Tampico Draw, Agua Remora, Tampico Spring, Galestino Creek, Yellowhouse Spring, Six Mile Creek, and Cebolla Creek. Zuni bluehead suckers were confirmed at all locations, except Galestino Creek, Yellowhouse Spring, Six Mile Creek, and Cebolla Creek. Surveys were sporadic between 1977 and 2003; then, in 2004, NMDGF began an annual monitoring program to assess the status of the Zuni bluehead sucker as a part of the NMDGF's efforts to recover the fish (Carman 2004, p. 2).

In this rule, we rely upon catch per unit effort, or catch rates, to evaluate Zuni bluehead sucker population trends after 1991 because of the limitations of survey data and variability in sampling effort. Catch rates are measured by the number of fish caught per second of electrofishing and provide a metric for evaluating population trends. No information on catch and effort is available prior to 1991; therefore, we may only make qualitative comparisons of the number or evaluate presence and absence of Zuni bluehead sucker collected over time for data prior to 1991. While catch per unit effort is valuable for assessing trends over time, it unfortunately does not allow us to develop overall population estimates for the species.

For example, in Tampico Draw, a tributary to Rio Nutria, Zuni bluehead sucker catch rates declined dramatically in 2005, from as high as 0.111 suckers per second to 0.0004 suckers per second. The decline is presumed to be a result of beaver (*Castor Canadensis*) dams (Gilbert and Carman 2011, p. 20). Catch rates appeared to rebound somewhat in 2009 (0.065 suckers per second) (Table 2), after high spring flows washed out the beaver dams, creating more suitable habitat for Zuni bluehead sucker (Gilbert and Carman 2011, p. 5). Larval Zuni bluehead suckers have been confirmed in the Rio Nutria and its headwater springs, including Tampico Draw, each year between 2007 and 2012, indicating successful spawning (Carman 2008, p. 1; Carman 2009, p. 18; Carman 2010, p. 15; Gilbert and Carman 2011, p. 1; NMDGF 2013, p. 25).

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TABLE 2.—Zuni bluehead sucker count data collected in New Mexico between 1977 and 2012.
Stream locations were based on regular sampling surveys after 2003, where data prior to 2004 were referenced on a map to provide consistency in reporting. Data collected from the following references in 1977 (Winter 1977, p. 1); 1978, 1979 (Hanson 1980, pp. 17, 29); 1984 (Stefferud 1985, p. 1); 1990 to 1993 (Propst and Hobbes 1996, p. 13); and 2000, 2001, and 2004 to 2012 (collected by Zuni Pueblo and NMDGF personnel) (Carman 2010, pp. 13–15; Gilbert and Carman 2011, p. 23, NMDGF 2013, p. 25).

Stream	1977	'78	'79	'84	'90	'91	'92	'93	2000	'01	'04	'05	'06	'07	'08	'09	'10	'11	'12
Zuni River	*	1	7	*	0	7	0	2	*	*	0	*	0	0	0	0	*	*	*
Rio Pescado	*	93	67	*	2	0	*	4	0	*	0	*	0	0	0	0	*	*	*
Rio Nutria at Gage	*	28	10	*	*	*	*	*	*	*	5	10	0	0	0	0	*	b	b
Rio Nutria Box	*	47	8	*	38	44	40	49	*	*	17	20	5	2	21	33	a	b	b
Rio Nutria at Confluence	*	81	10	*	*	3	*	13	*	*	76	117	36	43	4	118	40	111	236
Tampico Draw	*	0	1	*	0	11	*	*	49	*	22	32	1	0	1	33	9	17	58
Tampico Spring	*	1	1	*	*	*	*	*	*	*	*	*	*	77	130	48	53	49	109
Agua Remora	160	200	92	93	*	107	*	*	*	*	*	12	18	12	10	41	16	35	163

*No surveys conducted.
[a]Visual observation on Zuni Pueblo, Zuni bluehead sucker observed
[b]Visual observation on Zuni Pueblo, no Zuni bluehead sucker observed
For consistency, the last sampling event for each year is recorded in this table

Zuni bluehead suckers have persisted at Agua Remora, with catch rates ranging from 0.02 Zuni bluehead suckers per second to 0.34 fish per second (Table 2). Young (less than 5 cm (2 in) total length) Zuni bluehead

suckers have not been observed in the Agua Remora headwater spring habitat, and only mature adults were present there in 2005, 2006, and 2008 (Carman 2006, p. 8; Carman 2007, p. 13; Carman 2009, p. 14). The absence of young Zuni bluehead sucker correlates with low catch rate years and also with the presence of green sunfish, as evidenced by improved catch rates documented once the habitat was void of green sunfish after 2009.

Catch rates at Tampico Spring, within the Rio Nutria watershed, have been declining consistently in recent years; while this site once exhibited the highest catch rates for the species, at 0.589 suckers per second in 2007, numbers have since declined, with 0.106 fish caught per second in 2011 (Table 2). However, this population has shown improvement based on the 2012 survey with 0.210 fish caught per second (Table 2). Despite the prior declines at Tampico Spring, this population is showing signs of improvement (albeit one year), and the site continues to maintain the highest catch rates among sites within the Zuni River watershed for each year (NMDGF 2013, p. 26).

Although we cannot make statistical comparisons of all the catch data due to the lack of quantitative data prior to 1991, the presence of Zuni bluehead suckers collected throughout the Zuni River watershed can be assessed since 1977, where detections range from absent to few individuals (Table 3). For example, the number of Zuni bluehead suckers captured declined from 160 in 1977 (Winter 1977, p. 1), to 16 individuals in 2010 (Gilbert and Carman 2011, p. 23) (Table 3), but the population has shown improvement with 163 individuals being captured in 2012 (NMDGF 2013, p. 25). Both the Zuni River and Rio Pescado have been surveyed since 1993, but investigators have failed to collect Zuni bluehead sucker at either site since 1993 (as illustrated in Table 3). Both the Zuni River and Rio Pescado habitat are degraded and contain few areas with permanent flow. Where perennial water exists, suitable habitat is lacking and nonnative predators such as green sunfish and Northern pike (*Esox lucius*) dominate (Carman 2009, p. 2).

TABLE 3.—Catch per unit effort (CPUE) on the natural logarithm scale (catch rate = number of fish per second of electrofishing, metric = ln (catch rate + 1)) of Zuni bluehead sucker collected in New Mexico from 1991 to 2012 by Zuni Pueblo and NMDGF personnel (Carman 2009, p. 17 and NMDGF 2013, p. 26).
Blanks are years without catch rate data.

Stream	1991	1993	1994	1995	2000	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012
Zuni River	0.010						0				0				
Rio Pescado		0.002					0					0			
Rio Nutria at Gage		0.027	0.054	0.039			0.009	0.013		0	0			b	b
Rio Nutria Box	0.083		0		0	0	0.014	0.015	0.004	0.003	0.015	0.094	a	b	b
Rio Nutria at Confluence	0.010		0.099	0.045	0.062	0.102	0.052	0.132	0.050	0.064	0.041	0.126	0.049	0.089	0.135
Tampico Draw	0.08		0.015				0.023	0.111	0.0004	0	0.004	0.065	0.031	*	0.144
Tampico Spring			0.234							0.463	0.200	0.137	0.151	0.101	0.191
Agua Remora	0.149		0.093					0.022	0.013	0.021	0.010	0.118	0.029	0.035	0.293

[a]Visual observation on Zuni Pueblo; Zuni bluehead sucker observed.
[b]Visual observation on Zuni Pueblo; no Zuni bluehead sucker observed.
*CPUE data is missing.

In summary, in New Mexico, the Zuni bluehead sucker persists in three isolated populations over 3.7 km (2.3 mi), and fish surveys from 1990 to 2012 show that Zuni bluehead sucker populations in headwater springs like

Agua Remora and upper Rio Nutria have declined significantly from numbers seen in the 1970s. In the 1990s, the population at the Zuni River confluence with Rio Nutria and Rio Pescado was declining, and the populations in the Rio Pescado and lower Zuni River were almost depleted (Stroh and Propst 1993, p. 1). However, all persisting populations of Zuni bluehead sucker did show improvement in the last 2 years (NMDGF 2013, p. 26). These populations are highly sensitive to change, whether it is the presence of nonnative fish, beaver activity, or stream flow. The Zuni bluehead sucker has not been collected from the Zuni River or Rio Pescado since 1993 (Gilbert and Carman 2011, p. 1). In occupied areas, dispersal from upstream populations (i.e., Rio Nutria) may augment downstream populations, but both downstream and upstream movement is generally blocked by physical obstructions, such as natural waterfalls, irrigation diversions, and impoundments (Propst *et al.* 2001, p. 168). The irregular occurrence of the Zuni bluehead sucker in reaches downstream from the mouth of Rio Nutria Canyon (Rio Nutria, Zuni River, and Rio Pescado) indicates limited downstream dispersal from occupied stream reaches. No Zuni bluehead suckers were found in the Rio Nutria between the canyon mouth and the confluence of the Rio Pescado.

Arizona Distribution

In Arizona, Zuni bluehead suckers are found on the Navajo Indian Reservation in the Kinlichee Creek watershed. The Kinlichee Creek watershed is part of the Little Colorado River watershed west of Fort Defiance, Arizona, and the Zuni bluehead sucker has been documented in several locations over a 47-km (29-mi) area (Smith *et al.* 1983, p. 39; Crabtree and Buth 1987, p. 843; Hobbes 2000, pp. 9–16). This 47-km (29-mi) area includes Kinlichee Creek, Red Clay Wash, Black Soil Wash (also referred to as Black Soil Spring), and Scattered Willow Wash.

Zuni bluehead sucker survey efforts have been more irregular in Arizona than in New Mexico. Populations of Zuni bluehead sucker are found in several locations over approximately 47 km (29 mi) of Kinlichee Creek (Smith *et al.* 1983, p. 39; Crabtree and Buth 1987, p. 843; Hobbes 2000, pp. 9–16). It is unlikely that the whole length of the Kinlichee Creek watershed is occupied, because the streams are susceptible to drying during drought. In addition, no comprehensive surveys have been done along this stream reach. Within the watershed, the species occurs in Kinlichee Creek, Black Soil Wash, Red Clay Wash, and Scattered Willow Wash based on collections made in 2000, 2001, 2004, and 2012 (Hobbes 2000, pp. 9–16; Hobbes 2001a, pp. 38, 43; Hobbes 2001b, entire; Carman 2004, pp. 1–8; Kitcheyan and Mata 2013, p. 10).

Population Status of the Species in Arizona

For several years (2000, 2001, and 2004), Zuni bluehead sucker surveys were conducted in the Kinlichee Creek watershed in Arizona on the Navajo Indian Reservation (Hobbes 2001a, entire; Carman 2004, entire). These were historical collection sites that had not been sampled since 1987, when the Zuni bluehead sucker was last documented by Crabtree and Buth (1987, p. 851). The species was collected in low numbers in Kinlichee Creek, Black Soil Wash, and Scattered Willow Wash in 2000, 2001, and 2004. In 2012, collections occurred in Black Soil Wash and Kinlichee Creek, with 664 and 92 Zuni bluehead suckers, respectively (Kitcheyan and Mata 2013, p. 10), indicating the species' continued presence in these streams. Because these were only presence/absence surveys, we have no population estimates for the subspecies in Arizona.

Summary of Zuni Bluehead Sucker Distribution

Zuni bluehead sucker distribution has been reduced by an estimated 95 percent in the last 30 years in New Mexico (Propst 1999, p. 51; NMDGF 2004, p. 15; Service 2014a, pers. comm.). The extent of potential range reduction in Arizona is not known. The entire Kinlichee Creek watershed encompasses approximately 47 km (29 mi) (Smith *et al.* 1983, p. 39; Crabtree and Buth 1987, p. 843; Hobbes 2000, pp. 9–16). It is unlikely that the entirety of the Kinlichee Creek watershed is occupied because the streams are susceptible to drying during drought. The number of Zuni bluehead sucker found in the Kinlichee Creek watershed in Arizona range from zero to 664 individuals between 2000 and 2012 (Hobbes 2000, pp. 9–16; Albert 2001, pp. 10–14; NMDGF *et al.* 2003, p. 6–10); David 2006, p. 35, Kitcheyan and Mata 2013, pp. 10–11). The subspecies is restricted to three isolated populations in the upper Rio Nutria watershed in west-central New Mexico (Carman 2008, pp. 2–3).

Summary of Comments and Recommendations

We requested comments from the public on the proposed listing for the Zuni bluehead sucker during two comment periods. The first comment period associated with the publication of the proposed rule (78 FR 5369) opened on January 25, 2013, and closed on March 11, 2013. During our 6-month extension on the final determination for the Zuni bluehead sucker, we reopened the comment period from January 9, 2014 to February 10, 2014 (79 FR 1615). We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. Newspaper notices inviting general public comment were published in both the Gallup Independent and Navajo Times on January 25, 2013, and January 31, 2013, respectively. We did not receive any requests for a public hearing. All substantive information provided during comment periods has either been incorporated directly into this final determination or addressed below.

Peer Reviewer Comments

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from six knowledgeable individuals with scientific expertise that included familiarity with the Zuni bluehead sucker and its habitat, biological needs, and threats. We received responses from five of the peer reviewers. During the first comment period, we received some contradictory public comments, and we received new information relevant to the listing determination. For these reasons, we solicited expert opinions from 25 geneticists and taxonomists specifically to review the substantive discussion and information presented in the 6-month extension notice in light of disagreement regarding the taxonomic status of some populations that we considered Zuni bluehead sucker in the proposed rule. We received responses from three knowledgeable individuals with expertise in genetics and taxonomy. The peer reviewers generally concurred with our methods and conclusions and provided additional information, clarifications, and suggestions to improve the final listing rule. Peer reviewer comments are addressed in the following summary and incorporated into the final rule as appropriate.

(1) Comment: The primary reason for the imperilment of the species (habitat loss due to stream drying) was not adequately explained. The fact that nearly all historical habitat has been dewatered was buried in other information. This could be corrected by an upfront statement that the species is currently restricted to the only 4.8 km

(3 mi) of perennial water left within their historical habitat.

Our Response: Habitat loss due to stream drying is the primary reason for the imperilment of the species. However, in determining and evaluating threats to the Zuni bluehead sucker, we identify the sources of those threats. We identified water withdrawal and dams/impoundments as a source of habitat loss and stream drying, which is then exacerbated by climate change. In addition, we have refined our analysis and language in the *New Mexico Distribution, Population Status of the Species in New Mexico,* and Determination sections. The final rule mentions repeatedly that the species' distribution is limited to 3.7 km (2.3 mi) of stream habitat in New Mexico based on our reevaluation of the species' distribution in New Mexico.

(2) Comment: The discussion of disease is overstated; there is no evidence that black grub (*Neascus* spp.) is a threat to Zuni bluehead sucker.

Our Response: We acknowledge that the specific effects of black grub on the Zuni bluehead sucker are unknown. In determining whether or not disease is a threat to the Zuni bluehead sucker, we used the best scientific and commercial data available. This included articles published in peer-reviewed journals, data collected by NMDGF, and comments received on both the proposed rule and the 6-month extension of the final determination. Some of our citations are not specific to this species or geographic area. Nevertheless, the best scientific and commercial information available does not indicate that disease is a threat to the species rangewide, as stated in both the proposed and final rules. However, we conclude that black and yellow grub (a parasite that may affect the subspecies) may be a threat to the species in the future, as the parasite has profound effects on many other species of fish and has been detected in the Zuni bluehead sucker.

(3) Comment: The inclusion of the Canyon de Chelly populations is not appropriate based on the lack of published genetic support and the geographic separation between this population and those in the Little Colorado River watershed. Therefore, it is not appropriate to classify bluehead sucker in Canyon de Chelly as Zuni bluehead sucker. In addition, why did the Service include information on a catostomid (sucker family) population of uncertainty? This suggests that a comprehensive genetic investigation of all definitive and suspected Zuni bluehead suckers is needed prior to publishing a proposal to list the Zuni bluehead sucker as endangered. In addition, until genetic studies of catostomid populations are published in a peer-reviewed journal, it is inappropriate to consider these populations Zuni bluehead sucker.

Our Response: In the proposed rule, we identified populations in the Canyon de Chelly watershed as Zuni bluehead sucker because previous genetic analysis (Schwemm and Dowling 2008, entire) provided evidence supporting this conclusion. As mentioned in the ''Taxonomy and Genetics'' section, this conclusion was based on inaccurate information. Dowling (2014, entire) reevaluated and summarized Schwemm and Dowling (2008, entire) work during the open comment period for the 6-month extension notice, and he noted that our conclusion to identify the bluehead suckers in Canyon de Chelly as Zuni bluehead suckers was based on an error in the Schwemm and Dowling (2008, entire) genetic data. We made the appropriate changes in the final rule to reflect the correct identification of populations as Zuni bluehead sucker.

We used the best scientific and commercial data available to understand the contemporary and ancestral genetic patterns for the Zuni bluehead sucker. This included articles published in peer-reviewed journals, data not yet published, data collected by the Service, and data collected by NMDGF. When we announced the 6-month extension on the final determination for the Zuni bluehead sucker, we reopened the comment period and made all of the taxonomic and genetic information available to the public. Comments and information received were incorporated into our evaluation, as discussed in the ''Taxonomy and Genetics'' section. As discussed above, we identified populations of uncertainty (Canyon de Chelly in the Lower San Juan River watershed) as Zuni bluehead sucker at the time of the proposed rule because Schwemm and Dowling (2008) suggested that the Canyon de Chelly populations were Zuni bluehead sucker based on the presence of the Rio Grande sucker genetic signature. The Canyon de Chelly populations of bluehead sucker are not included in this final listing determination, however, because there is no longer morphological or genetic evidence to indicate that they are Zuni bluehead sucker. However, it is possible that future analysis of these populations in Canyon de Chelly may indicate the presence of Zuni bluehead suckers.

(4) Comment: The taxonomy and genetics discussion is confusing in the proposed rule. It is not sufficient to say that populations that are geographically proximate (near each other) are the same taxonomically.

Our Response: The reference to proximity in the proposed rule was intended to describe past and present connectivity of streams in the Canyon de Chelly watershed and to describe that the bluehead sucker population within the Canyon de Chelly watershed were considered to be genetically related to one another. However, our evaluation of the taxonomy and genetics information no longer supports that bluehead suckers in the Canyon de Chelly watershed are Zuni bluehead suckers (see response to comment 3 and ''Taxonomy and Genetics'' section).

(5) Comment: One peer reviewer suggested that the Service clarify that investigators conducting their bluehead sucker surveys in Kinlichee Creek correctly identified their fish captured as bluehead suckers and produced their reports on that basis, and the Service later attributed their bluehead sucker to the subspecies of the Zuni bluehead sucker.

Our Response: In response to this comment, we added language after first use of the NMDGF *et al.* (2003, entire) and David (2006, entire) citation in the *Arizona Distribution* section. As stated, in the *Arizona Distribution* section, investigators could not determine whether the bluehead suckers captured were bluehead suckers or Zuni bluehead suckers through external features and believed the taxon designation as a Zuni bluehead sucker was uncertain. However, Smith *et al.* (1983, p. 46), provides information on how to morphologically distinguish a Zuni bluehead sucker from a Rio Grande sucker and bluehead sucker based on several characters (gill rakers, lower jaw, lips, vertebral counts, and fin ray counts). Based on the Smith *et al.* (1983, p. 46) morphological analysis of Zuni bluehead sucker in Kinlichee Creek, the Service attributed the bluehead suckers captured in NMDGF *et al.* (2003, entire) and David (2006, entire), as Zuni bluehead sucker.

Comments From States

We received one comment from the Arizona Game and Fish Department (AGFD) supporting the listing. The NMDGF provided their most recent Zuni bluehead sucker annual report that was used to update population status of the Zuni bluehead sucker in the Zuni River watershed. Please refer to the *Population Status of the Species in New Mexico* section, above.

(6) Comment: Prior to 1991, catch data were not standardized by effort (catch per unit effort) and cannot be compared with catch data that was standardized.

Conclusions derived from comparisons of data prior to 1991 are methodologically erroneous.

Our Response: As stated within the *Population Status of the Species in New Mexico* section, we acknowledge both the correct and incorrect use of catch per unit effort data. While catch per unit effort is valuable for assessing population trends over time and assessing species' status, this metric does not allow us to develop overall population estimates for the species. We have revised this discussion and added additional language for accuracy and clarification.

(7) Comment: Historical population data are not provided for Zuni bluehead sucker habitat in New Mexico, and, therefore, the effect of habitat loss on the species' populations is unknowable; a 90 percent reduction in habitat does not unequivocally suggest any significant loss to population. In addition, the Service makes no remark on the suitability of the lost habitat.

Our Response: Since the proposed rule, the Service has acknowledged that we do not know the historical range for the Kinlichee Creek watershed of the Little Colorado River watershed in Arizona. However, based on available maps and survey information, we estimate the present range of the Zuni bluehead sucker in New Mexico to be approximately 5 percent or less of its historical range, and the status of the species within the occupied areas range from common to absent (see *Population Status of the Species in New Mexico* section). Habitat loss and range reduction is directly related to loss of populations given that the species was historically found in habitats that are no longer suitable and the Zuni bluehead sucker are now absent in those habitats. In addition, we have included language within the *Population Status of the Species in New Mexico* section to remark on the suitability of habitat where the Zuni bluehead sucker is absent.

(8) Comment: Without a clear definition of the subspecies and the populations that comprise that subspecies, the Service does not have adequate information to clearly state this subspecies warrants protection under the Act.

Our Response: Our evaluation of morphological and genetic information supports the recognition of the Zuni bluehead sucker as being distinct from both the Rio Grande sucker and the bluehead sucker (Smith 1966, pp. 87–90; Smith *et al.* 1983, pp. 37–38; Crabtree and Buth 1987, p. 843; Propst 1999, p. 49). Based on our review of the best available scientific and commercial data, we conclude that the Zuni bluehead sucker is a valid subspecies. As discussed in the ''Taxonomy and Genetics'' section we have assessed all populations that comprise the Zuni bluehead sucker.

(9) Comment: The Service does not adequately understand the contemporary and historical distribution of the Zuni bluehead sucker to assert that the Zuni bluehead sucker is in danger of extinction throughout all or a significant portion of its range.

Our Response: We used the best scientific and commercial data available to understand the contemporary and historical distribution of the Zuni bluehead sucker. This included articles published in peer-reviewed journals, data collected by the Service and data collected by NMDGF. Please refer to the ''Distribution'' section for an explanation of the contemporary and historical distribution of the Zuni bluehead sucker.

(10) Comment: The Service exaggerates the level of threat to Zuni bluehead sucker resulting from exotic species. The limited geographic distribution and rarity of the nonnative species in the Zuni River watershed serve to lessen their widespread impact to the Zuni bluehead sucker.

Our Response: The Zuni bluehead sucker occurs only in stream and spring habitats that are comparatively free of nonnative fishes. The Zuni bluehead sucker has coexisted with several introduced piscivorous (primarily eats fish) nonnative fish (e.g., sunfish, northern pike, and largemouth bass). However, several surveys and reports have provided evidence that Zuni bluehead sucker are low or absent in the presence of piscivorous nonnative fishes (Hanson 1980, p. 2; Propst and Hobbes 1996, pp. 38–39, Propst *et al.* 2001, p. 162; Carman 2008, p. 17). In addition, we have provided additional information regarding effects of exotic crayfish on benthic fishes within the ''Factor C: Disease and Predation'' section.

(11) Comment: The Service fails to consider the adequacy of all relevant and applicable existing mechanisms that provide protection for the Zuni bluehead sucker in New Mexico. In addition, the Service fails to incorporate analysis of the 2004 New Mexico Game and Fish Department's Zuni bluehead sucker recovery plan in the proposed listing.

Our Response: In response to this comment, we added language within the ''State Regulation'' section. We acknowledge the NMDGF developed a recovery plan for the Zuni bluehead sucker in 2004 (NMDGF 2004, entire). The objective of the recovery plan is that, by 2015, the populations and distribution of the Zuni bluehead sucker are sufficient to ensure its persistence within New Mexico and thereby warrant its removal from the State endangered species list. The recovery plan does not restrict activities that would be likely to adversely affect the species or its habitat and, likewise, does not require activities that would be likely to benefit the species or its habitat; however, the recovery plan and implementation has vital information on the Zuni bluehead sucker. As noted above, the State's recovery plan does not ensure any long-term protection for the Zuni bluehead sucker because there are no mandatory elements or funding dedicated to ensure the recovery plan is implemented. In addition, NMDGF's does not have the authorization to restrict proposed projects that may adversely affect these species or their habitat.

Comments From Navajo Nation

(12) Comment: The genetic information does not support the assertion by the Service that bluehead sucker populations in the Chuska Mountains (referred to in the listing rule as Canyon de Chelly) and Defiance Plateau (referred to as Kinlichee Creek watershed) should be identified as Zuni bluehead sucker populations; rather, these populations may be a unique variation of bluehead sucker. It is necessary to conduct peer-reviewed publication of a genetic analysis of these bluehead suckers and to include a morphological study to determine the taxon of the suckers.

Our Response: Based on our updated analysis, which includes information received since the publication of the proposed rule, the best scientific and commercial information available on taxonomy and genetics of Zuni bluehead suckers supports that the bluehead sucker populations in the Canyon de Chelly watershed are not Zuni bluehead sucker. Thus, we no longer consider the bluehead suckers in the Canyon de Chelly watershed of the Lower San Juan River watershed at the border of Arizona and New Mexico to be Zuni bluehead suckers. Please refer to the ''Taxonomy and Genetics'' section, and response to Comment 3.

Alternatively, based on our assessment of the best scientific and commercial information available, the literature supports the presence of Zuni bluehead sucker on Navajo Nation in the Kinlichee Creek watershed. Smith *et al.* (1983, pp. 38, 42) identified samples collected from Kinlichee Creek as Zuni bluehead sucker, primarily based on morphological similarities to Zuni

bluehead suckers found in the Rio Nutria.

At the time of the proposed listing rule and the 6-month extension notice, we specifically solicited peer review from knowledgeable individuals with scientific expertise that included familiarity with the subspecies, the geographic region in which the subspecies occurs, and taxonomy of the subspecies. Additionally, we requested comments or information from other concerned governmental agencies, Native American Tribes, the scientific community, industry, and any other interested parties concerning the proposed rule. Comments and information we received helped inform this final rule. We used multiple sources of information, including: Results of numerous surveys, peer-reviewed literature, unpublished reports by scientists and biological consultants, geospatial analysis, and expert opinion from biologists with experience studying the subspecies. This information constitutes the best scientific and commercial data available and has been incorporated into this final listing rule.

(13) Comment: More genetic markers need to be reviewed to make an accurate decision on what populations should and should not be identified as Zuni bluehead suckers.

Our Response: We are charged with using the best scientific and commercially available information in a listing determination. We acknowledge that additional research would be valuable; however, we are required by law to use the best information currently available for the species. The Act requires that we adhere to a timeframe in developing our determination and we do not have the funding or authority to delay our determination in order to conduct studies to collect empirical data on each topic of discussion.

(14) Comment: The Navajo Nation does not consider logging to be a threat to their bluehead suckers and provided information regarding the Navajo Nation 10-year Forest Management Plan (Navajo Nation 2000, entire).

Our Response: We have incorporated the Navajo Nation 10-year Forest Management Plan within the Tribal Regulations section. The Navajo Nation 10-year Forest Management Plan will reduce this threat in the Kinlichee Creek watershed, where logging prescriptions are in place to protect the riparian areas. However, this plan does not provide protection from other threats to the species, and it does not provide protection to the species throughout the entirety of its range (specifically in the Zuni River watershed).

(15) Comment: The Navajo Nation identified several publications to support their assertion that the bluehead suckers on the Navajo Nation (Kinlichee Creek watershed and Canyon de Chelly watershed) are not Zuni bluehead suckers. The following citations were provided:

a. Crabtree and Buth (1987, entire) looked at sucker allozymes and determined that the Kinlichee Creek population of suckers was bluehead suckers rather than Zuni bluehead suckers.

b. Hopken *et al.* (2013, entire) determined that the Canyon de Chelly population of suckers is bluehead suckers and not Zuni bluehead suckers.

c. Douglas *et al.* (2009, entire) determined that the populations of suckers found within the area of Navajo Nation are bluehead suckers, not Zuni bluehead suckers.

d. Smith *et al.* (1983, entire) determined Canyon de Chelly and Whiskey Creek suckers are not Zuni bluehead sucker.

Our Response: Hopken *et al.* (2013, entire) and Douglas *et al.* (2009, entire) are the same studies using the same genetic samples and analysis. Both of their studies included genetic samples from bluehead sucker found in the Canyon de Chelly watershed only. As noted previously, the Canyon de Chelly taxon has been attributed to the bluehead sucker and not the Zuni bluehead sucker in this final listing rule. During our review of Crabtree and Buth (1987, entire), we understand that they identified fish from Kinlichee Creek as Zuni bluehead sucker based on the expression of several unique allozymes that were genetically distinct from bluehead sucker or Rio Grande suckers (Crabtree and Buth 1987, pp. 843, 848, Table 2, 852). Crabtree and Buth (1987, pp. 851–852) suggested that the genetic interaction between the Rio Grande sucker and bluehead sucker is limited to the upper Rio Nutria populations in the Zuni River watershed. However, Crabtree and Buth (1987, p. 852) state that the Zuni bluehead sucker is a distinct subspecies regardless of its genetic interaction with the Rio Grande sucker. Smith *et al.* (1983, entire) could not genetically distinguish the bluehead sucker from Kinlichee Creek or Whiskey Creek; however, they attributed their taxon recognition of Zuni bluehead sucker based on morphological similarities between the Kinlichee Creek watershed and Zuni River watershed. Please refer to the ''Taxonomy and Genetics'' for more information.

Public Comments

(16) Comment: There could be implications imposed on the rights of private property owners as a result of the listing rule.

Our Response: The Act requires that we make listing determinations ''solely on the basis of the best available scientific and commercial data available'' (16 U.S.C. 1533(b)(1)(A)). The Act does not allow listing to be avoided based on the potential for perceived economic benefits or burdens that may result from the listing. Listing a species as threatened or endangered does not revoke constitutionally protected property rights (see the Fifth Amendment to the U.S. Constitution). Executive Order 12630 (Government Actions and Interference with Constitutionally Protected Private Property Rights) requires that we analyze the potential takings implications of designating critical habitat for a species in a takings implications assessment.

(17) Comment: Listing the Zuni bluehead sucker would limit State agencies' ability to manage for this species. Management of species by the Federal Government is unlikely to improve the status of the species.

Our Response: The potential efficacy of a listing action to conserve a species cannot be considered in making the listing decision. The Service must make its determination based on a consideration of the factors affecting the species, utilizing only the best scientific and commercial information available, and is not able to consider other factors or impacts. Listing recognizes the status of the species and invokes protection and considerations under the Act, including regulatory provisions, consideration of Federal activities that may affect the species, and potential critical habitat designation. In addition, the Service will develop a recovery plan. The recovery plan will likely identify both State and Federal efforts for conservation of these species and establish a framework for agencies and stakeholders to coordinate activities and cooperate with each other in conservation efforts. The plan will set recovery priorities and describe site-specific management actions necessary to achieve conservation and survival of the Zuni bluehead sucker. Thereby, with the help of Federal, State, Tribal, and private partners, we can develop conservation measures to improve the status of the species.

(18) Comment: The basis for determining whether the species is endangered or threatened appears to have been present in 1996, when the

species was no longer listed as a candidate species. As such, it would appear that listing is as unwarranted now as it was in 1996.

Our Response: Prior to 1996, the Zuni bluehead sucker was considered a Category 2 candidate species. This designation meant a species for which we had information that proposed listing was possibly appropriate, but conclusive data on biological vulnerability and threats were not available to support a proposed rule at the time. In 1996, however, we discontinued the designation of Category 2 species as candidates, and all existing Category 2 candidates were removed from the candidate list. As stated in the Previous Federal Actions section of both the proposed and final rules, the Zuni bluehead sucker was again added to the candidate list in 2001 (66 FR 54807, October 20, 2001). A candidate species is one for which we have on file sufficient information on biological vulnerability and threats to support a proposal for listing as endangered or threatened, but for which preparation and publication of a proposal is precluded by higher priority listing actions. We have analyzed the threats to the species based upon the five factors described in section 4(a)(1) of the Act. We have determined based on our analysis of threats discussed below in the section Summary of Factors Affecting the Species that the Zuni bluehead sucker is in danger of extinction throughout all of its range.

(19) Comment: It is unclear whether all historical and currently occupied areas have been surveyed.

Our Response: A complete overview of the available survey data for the Zuni bluehead sucker is reported in the ''Distribution'' section, above. All known historical and currently occupied areas have been sampled extensively in New Mexico by NMDGF and its partners. During the development of this rulemaking, the Service and the Navajo Nation initiated surveys to sample all known historical and currently occupied habitats, as well as previously unsurveyed areas of habitat for the Zuni bluehead sucker in Arizona and New Mexico. This information has been added to the ''Distribution'' section above.

(20) Comment: In the proposed rule, the Service assumes that there was historically continuous flow in both the Little Colorado River and Zuni River watersheds. However, there is no information offered in the rule to substantiate this assumption.

Our Response: During the last glaciation period (15 to 24 thousand years ago) the region where the Zuni bluehead sucker is found was much wetter (Thompson *et al.* 1983, p. 498; Wagner *et al.* 2010, p. 111). There was sufficient precipitation and runoff to sustain a large lake on the San Agustin plain (Allen 2005, p. 112). Under similar precipitation conditions today, watersheds occupied by Zuni bluehead sucker would have been perennial. Thus, based on the best scientific and commercial data available, we believe that, historically, there was continuous flow in both watersheds.

(21) Comment: In the rule, the Service assumes that there would not be erosion without logging or other activities on the land. However, it is widely known that erosion is directly related to the structure of the soils being more erosive than others, causing sedimentation even in environments that are only affected by the natural elements. As such, it is inappropriate to blame stream sedimentation on logging activities without acknowledging that erosion is normal and the extent to which it increases is influenced by many factors, only one of which could be by harvest activities which are undertaken to reduce wildfire risk.

Our Response: We acknowledge that both natural and anthropogenic processes can cause erosion. Changes in erosion rates can result from natural causes, such as soil conditions that are highly susceptible to erosion, or these changes may result from historical land-use practices that minimize grass and tree cover, making current conditions more susceptible to erosion. We encourage implementation of best management practices today that can reduce or improve erosional conditions. We need the help of private and public land managers to implement these practices to improve the watershed conditions where the Zuni bluehead sucker occurs.

(22) Comment: The Service should take immediate action to implement conservation measures to protect the Zuni bluehead sucker.

Our Response: The final listing of any species imposes some restrictions on activities that may impact the species (i.e., water development, forestry management). As outlined in Section 9 of the Act and our Interagency Cooperative Policy for Endangered Species Act Section 9 Prohibitions (July 1, 1994; 59 FR 34272), ''take'' of species listed as endangered or threatened is prohibited. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt any of these, import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. We identified in the proposed rule those activities that we believe would or would not constitute a violation of the prohibitions identified in section 9 of the Act. The final Federal listing of the Zuni bluehead sucker under the Act requires that Federal agencies consult with the Service on activities involving Federal funding, a Federal permit, Federal authorization, or other Federal actions. Consultation (under section 7 of the Act) is required when activities have the potential to affect the Zuni bluehead sucker or designated critical habitat. The consultation will analyze and determine to what degree the species is impacted by the proposed action. Section 7 of the Act prohibits actions funded, authorized, or carried out by Federal agencies from jeopardizing the continued existence of a listed species or destroying or adversely modifying the listed species' critical habitat. Therefore, restriction or mitigation for certain activities may be appropriate if identified during a section 7 consultation, where a Federal nexus exists.

In addition, management recommendations as may be necessary to achieve conservation and survival of the species can also be addressed through recovery planning efforts. Under section 4(f)(1) of the Act, we are required to develop and implement plans for the conservation and survival of endangered and threatened species, unless the Secretary of the Interior finds that such a plan will not promote the conservation of the species. We will move to accomplish these tasks as soon as feasible.

(23) Comment: The proposed listing of a subspecies is unscientific and unwarranted.

Our Response: Section 3 of the Act provides definitions for the purposes of the Act. As stated in section 3(16), the term ''species'' includes any subspecies of fish or wildlife or plants. The Zuni bluehead sucker is recognized by the biological community as a valid subspecies, and thus, meets the definition of a species under the Act. Therefore, it is appropriate for the Service to evaluate the Zuni bluehead sucker for listing under the Act.

(24) Comment: The proposed rule does not clarify which Tampico Spring is being referenced where the Zuni bluehead sucker are known to occur.

Our Response: We have added language to clarify that the Tampico Spring occupied by Zuni bluehead suckers occurs on private land on the west side of the Oso Ridge and is not identified on a topographic map. This Tampico Spring should not be confused

with the Tampico Spring on the east side of Oso Ridge identified on topographic maps and located on public land,. Please see *New Mexico Distribution* section for the description of Tampico Spring.

(25) Comment: The proposed rule states that, in 2001, NMDGF received permission from the landowner to conduct sampling at Tampico Spring for the first time since 1994. Zuni bluehead sucker were removed from Tampico Spring by the Service, NMDGF, and Albuquerque Biopark biologists. The proposal claims the rate of catch at Tampico Spring subsequently declined. Was the cause of the decline the removal of specimen, electrofishing, or the introduction of organisms that may have been on the sampling gear, the buckets, or the waders?

Our Response: As stated in the *Population Status of the Species in New Mexico* section, Tampico Spring and all other occupied areas of Zuni bluehead sucker in the Zuni River watershed have all seen a period of decline. However, all catch rates for the Zuni bluehead sucker have shown improvement in the 2012 survey efforts. The observed decline of the population was not an artifact of fish removal, electrofishing, or an introduced organism. We know this because approximately 50 individuals were collected from Tampico Spring between 2007 and 2008 (NMDGF 2013, p. 33), and Zuni bluehead suckers have been spawning and producing offspring (NMDGF 2013, p. 23). Electrofishing can be lethal, but, when used properly, potentially harmful effects of electrofishing are significantly reduced and mortality is minimal. We are unaware of any introduced organism in Tampico Spring, and it is common practice to disinfect waders and fish collection gear to reduce the chance of introduction of any organism to a system. We do not have a direct link for the observed decline, other than it is likely a combination of factors, such as the habitat being inundated with silt; furthermore, the population exhibits facial deformities, and whether that effects survival is unknown.

(26) Comment: We received comments regarding the correct use of scientific literature in the livestock grazing section of the proposed rule and whether the documents were unbiased. In addition, it is not clear how Larsen *et al.* (1998, entire) can be used as a reference to support the statement that livestock grazing causes adverse impacts to native fishes and their habitat because the reference shows that Larsen questions the defensibility of the wealth of the literature on livestock grazing. Thus, it seems the literature exhibits personal opinion or commentary interspersed with little scientifically valid experimentation.

Our Response: We are charged with using the best scientific and commercially available information in a listing determination. The discussion on livestock grazing in the proposed and final rules cites many studies and authors on the topic of livestock grazing impacts to aquatic systems. Although some of our citations are not specific to this species or the geographic area, the citations offer evidence that certain threats exist because similar examples have been documented elsewhere, and, based on biological principles and effects observed in other fishes, we can draw reasonable conclusions about what we would expect to happen to this species. It is well understood in the scientific community that improper grazing has impacts on stream habitat and fish communities. We have added or modified several of the livestock grazing citations to reflect effects of livestock grazing on fish habitats and populations.

We have also made some changes in the livestock grazing section of the final rule in direct response to the commenter's question on the incorporation of Larsen *et al.* (1998, entire). Larsen *et al.* (1998, pp. 161, 164) was an incorrect use for the specific statement the commenter referenced, and, in fact, the page numbers do not match with that publication. This citation was removed from the final rule. Although Larsen *et al.* 1998 (p. 664) concludes that the base of the commonly accepted body of knowledge of livestock influences on riparian zones and fish habitat is made up of many reports that are not experimentally or statistically adequate, the authors were able to generalize several points from their literature review. These generalizations include: (1) It is clear that livestock or big game can and do coexist within sustainable riparian systems; likewise, livestock and big game can and sometimes do change riparian vegetation structure in undesirable ways; (2) Vegetation responses are highly site specific; and (3) Ecosystems are highly variable in space and time. Most driving forces that change ecosystems seem to result from interactions of factors (Larsen *et al.* 1998, p. 664). Therefore, based on the generalization, livestock grazing impacts are site-specific and can be exacerbated by other factors in the environment.

(27) Comment: The citation used for the conclusion paragraph for historical logging, overgrazing by livestock, and road construction does not have a single empirical data point to support the conclusion.

Our Response: We are charged with using the best scientific and commercially available information in a rule. We acknowledge that additional research would be valuable; however, the Act requires that we use the best information currently available for the species or similar species. The Act requires that we adhere to a timeframe in developing our determination, and we do not have the funding or authority to conduct studies to collect empirical data on each topic of discussion. We have updated and included additional information in the ''Summary of Factors Affecting the Species'' in which we describe the types of land management practices (logging, livestock grazing, and road construction) both in the past and present that have influenced the landscape inhabited by the Zuni bluehead sucker. In addition, we provide information related to these land management practices that have been seen to influence many fish species and their habitats. We will need the help of private and public land managers to implement best management practices to improve conditions where the Zuni bluehead sucker occurs. This may include the need to increase the genetic diversity by introducing other Zuni bluehead suckers into the system to increase diversity as we have done for other fish species.

(28) Comment: The proposal cites Miller (1961, pp. 394–395) in the discussion of grazing and erosion, but it would have been better to have embraced the following citation from Miller (1961, p. 398):

''The use of toxic chemicals, such as rotenone and toxaphene, for the control or eradication of fish populations may have serious consequences for the native species. Such a management tool is being employed more and more widely in the control of ''rough fish''; without prior determination of its harmful effects, this practice may needlessly exterminate localized species or relict populations (see above and Koster, 1957: 106). Its relatively indiscriminate use in streams has already reduced certain native fishes to dangerously low levels or has seemingly brought about extinction (Clark Hubbs. In litt., 1960). Conservationists should make a determined effort to prevent the decimation of aquatic biota in this way, if necessary through the enactment of protective legislation.''

Our Response: In the *New Mexico Distribution Section,* we acknowledge that Zuni bluehead sucker numbers have been starkly reduced in the Zuni

River watershed in New Mexico, largely due to 27 chemical treatments during the 1960s. The past use of chemical treatments in the 1960s and 1970s has affected the Zuni bluehead sucker; however, going forward, the use of chemical treatments can be beneficial to native fishes if used properly. As Miller suggests, ''Conservationists should make a determined effort to prevent the decimation of aquatic biota . . .'' and as a practice when the Service is conducting nonnative fish eradication, we collect and hold native fishes for reintroduction until the chemical treatment is complete.

(29) Comment: The ''Water Withdrawal'' section of the proposed rule does not have any empirical data, and the citations used are not relevant to the Zuni bluehead sucker or the Zuni River watershed. How do agricultural and industrial water needs compare to vacation home needs?

Our Response: Our assessment that water withdrawal is a threat to the Zuni bluehead sucker is based on the best scientific and commercial data available. We reviewed articles published in peer-reviewed journals, agency reports, and comments received on both the proposed rule and the 6-month extension of the final determination. Some of our citations are not specific to this species or the geographic area; nevertheless, we can ascertain that water withdrawal can have negative impacts on the Zuni bluehead sucker and their habitat. The ''Water Withdrawal'' section assesses all sources of water withdrawal, including agriculture, livestock, mining, and municipal water use. The majority of the water within the Lower Colorado River Basin in New Mexico is consumed for agriculture and mining; however, additional uses include domestic (self-supplied) and public water supply (New Mexico Office of the State Engineer 2010, p. 1). As stated in Orr (1987, p. 1), the population of the Pueblo of Zuni was increasing rapidly and, thus, increasing the need for additional municipal and domestic water supplies; therefore, the U.S. Geological Survey conducted a comprehensive water-resources study on Zuni Tribal lands. The results of this study identified that several aquifers' water-levels were in decline during a 10-year period, which could be the result of pumping for well withdrawals (Orr 1987, pp. 42–44). The consumption of water within the Lower Colorado River Basin through various sources has increased by as much as 56 percent between 1990 and 2005 (New Mexico Office of the State Engineer 1990, p. 1; New Mexico Office of the State Engineer 2005, p. 1). Based on our review of the available information, we conclude that the effects of water withdrawal are a continuing threat to the Zuni bluehead sucker habitat across its range and, as a result, are negatively affecting the species. We used these examples in the rule to depict how water withdrawals for agriculture and mining have impacted flow to rivers or springs. Water withdrawal within the range of the Zuni bluehead sucker is not just the result of vacation homes (see description above), but is the result of a culmination of municipal, agricultural, and livestock activities.

(30) Comment: The hydrological studies referenced by the 2011 Final Environmental Impact Statement by the U.S. Forest Service for the Forest Roads 191 and 191D project indicates minimal anticipated impact on the discharge into the Rio Nutria even in a worst-case scenario.

Our Response: The U.S. Forest Service (2011, p. 32) states that MJDarrconsult, Inc. (2007, entire) and Glorieta Geoscience, Inc. (2007, entire) show a small amount of drawdown, from 0.03 to 0.04 meters (m) (0.09 to 0.14 feet (ft)), could occur at Nutria Springs. However, neither model takes into account current natural recharge or return flow, and, when either of these factors is considered, the drawdown predicted at Nutria Springs becomes negligible (Congdon, 2009, entire). As discussed in the ''Climate Change'' section below, the outlook presented for the Southwest predicts warmer, drier, drought-like conditions (Seager *et al.* 2007, p. 1181; Hoerling and Eischeid 2007, p. 19). A decline in water resources will be a significant factor in the compromised watersheds of the Desert Southwest, ultimately affecting the future natural recharges rates for aquifers.

(31) Comment: There is no empirical data that connects sedimentation with adverse effects on the Zuni bluehead sucker, and the citations used in the ''Sedimentation'' section of the proposed rule are questionable. Much of the language used is the section uses the word ''may'', which characterizes many of the statements as a yet-to-be-tested hypothesis.

Our Response: Please see the response to comment 27 regarding empirical data. We are charged with using the best scientific and commercially available information in a rule. We have added additional language in the ''Sedimentation'' section to describe known impacts of sedimentation on fishes and fish habitats. Although these examples are not species-specific, we can ascertain that similar effects may occur for the Zuni bluehead sucker. We are using the best scientific and commercial information available and that information can sometimes only lead us to a ''may'' conclusion rather than a definitive statement.

(32) Comment: Does the existence of the inbred colonies at Agua Remora and Tampico Springs, with their mutations and limited genetic diversity, pose a threat to the overall survival of the subspecies? Fish from the Rio Nutria cannot travel upstream past the waterfall barriers. But mutated fish from the Agua Remora and Tampico Springs can be washed downstream with seasonal runoff. These fish can then breed with the main population and introduce their mutated genes into the Rio Nutria population. Would that fertilization then reduce the survival rate of the Rio Nutria population over time? Has a decline in the population in the Rio Nutria already been observed?

Our Response: A species relies on genetic diversity to survive, and low diversity usually indicates that the population has been inbreeding due to a decrease in populations, which is described in the ''Taxonomy and Genetics'' section. We have determined that small population sizes and limited genetic diversity are a concern for the Zuni bluehead sucker viability. This is why the New Mexico Department of Game and Fish funded research efforts to look at the genetic diversity of the Zuni bluehead sucker in the Zuni River watershed and established a captive rearing program. Zuni bluehead sucker both from Aqua Remora and Tampico Spring are successfully reproducing in captivity. In addition, these populations were combined and successfully reproduced as well. We will need help of private and public land managers to implement management practice to improve conditions where the Zuni bluehead sucker occurs. This may include the need to increase the genetic diversity by introducing other Zuni bluehead suckers into the system to increase diversity as done for other fish species. We do not anticipate the mixing of these populations to be a threat because, if the population mixed, it may increase the genetic diversity. In addition, as described in the *''Population Status of the Species in New Mexico''* section, Rio Nutria has experienced declines since the 1970s, as have all other locations in the Zuni River watershed. However, the Zuni bluehead sucker does appear to be on the rise in Rio Nutria.

Summary of Changes From Proposed Rule

Based upon our review of the public comments, comments from State and

Tribal agencies, peer review comments, and any new relevant information that may have been available since the publication of the proposal, we reevaluated our proposed rule and made changes as appropriate. During the open comment periods, we were asked to incorporate additional information, which was provided or suggested, and to provide clarification in some areas. We have added both additional and clarifying language regarding our understanding of water withdrawal, sedimentation, logging, livestock grazing, and housing development. We also added additional language to Factor D regarding existing conservation plans and agreements, including the New Mexico Zuni bluehead sucker recovery plan (NMDGF 2004, entire). Navajo Nation provided substantial information regarding several plans and policies that have been developed by the Navajo Nation Department of Fish and Wildlife, the Navajo Nation Environmental Protection Agency, and the Navajo Nation Forestry Department. All of these plans and policies have been incorporated into the Tribal Regulations section in Factor D.

During the two comment periods on the proposed rule and the 6-month extension, the Service received additional information, clarification, and comment to assist with identifying populations of Zuni bluehead sucker based on taxonomy and genetics. The Service has provided substantial information within the ''Taxonomy and Genetics'' section of the rule above. The information incorporated above clarifies which populations are considered Zuni bluehead sucker based on information received since the publication of the proposed rule. We are charged with using the best scientific and commercially available information relevant to the taxonomy and genetics and have incorporated this new information into this rule to substantiate the identified populations of the Zuni bluehead sucker. However, this information has also removed populations from the Canyon de Chelly watershed in the Lower San Juan River watershed from this final listing rule because these populations have been identified as bluehead sucker and not Zuni bluehead sucker. This additional information did not alter our threats assessment, but rather confirms that the Service's determination of endangered status is appropriate because fewer geographically isolated populations exist than previously proposed and threats remain high across those populations.

Summary of Factors Affecting the Species

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 any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

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

The principal threats to Zuni bluehead sucker habitat include water withdrawal, sedimentation, impoundments, housing development, wildfire, and climate change. These threats are intensified by the species' small range. Severe degradation to watersheds occupied by Zuni bluehead sucker has occurred through excessive timber harvest, overgrazing, and road construction. Although most of these activities occurred in the late 1800s and early 1900s, the subsequent erosion, gullying, headcutting (an erosional feature of some intermittent or perennial streams where an abrupt vertical drop occurs in the stream bed creating a steep riffle zone or waterfall that continues to erode), and loss of water have continued to degrade habitat for the Zuni bluehead sucker (as discussed in detail below) (Natural Resources Conservation Service (NRCS) 1998, entire).

Water Withdrawal

Surface and groundwater withdrawal result in the direct loss of habitat as well as fragmentation of Zuni bluehead sucker habitat by reducing stream flow or water depth. Reduced stream velocities result in increased sedimentation, while overall loss of wetted habitat strands Zuni bluehead suckers in isolated shallow pools that may not provide suitable hard substrates for feeding and reproduction. Loss of appropriate habitat may decrease the reproductive success of Zuni bluehead sucker and result in mortality of individuals. Historically, water withdrawals led to the conversion of large portions of flowing streams to intermittent streams or dewatered channels, thus eliminating suitable Zuni bluehead sucker habitat in affected areas (NMDGF 2004, p. 12). Water withdrawals that lead to dewatering or reduced river flows or pool levels reduce the available habitat for the species.

Groundwater withdrawal can cause reduction or loss of spring flow (Brune 2002, p. 356). Within the Zuni River watershed, various springs occur across Zuni Pueblo lands (Orr 1987, p. 37; Drakos and Riesterer 2009, p. 96). Discharge from these springs feeds into several intermittent streams in the watershed, including the Zuni River, the Rio Pescado, and the Rio Nutria. These streams flow intermittently, except for short reaches that flow perennially in response to discharge from springs (Orr 1978, p. 37; NMDGF 2013, p. 9). Because spring ecosystems rely on water discharged to the surface from underground aquifers, groundwater depletion can result in the destruction of riverine habitat through spring drying (Scudday 1977, pp. 515–516). Spring drying or flow reduction resulting from groundwater pumping has also been documented in the Roswell (August 9, 2005; 70 FR 46304) and Mimbres Basins (Summers 1976, pp. 62, 65) of New Mexico. Orr's (1987, pp. 42–44) study identified that several aquifers' water levels were in decline during a 10-year period where pumping from well withdrawals may have been the cause. In addition, spring flow found on Zuni Tribal lands generally declined between 1972 and 2009 (Drakos and Riesterer 2009, p. 96). By definition, a spring is the result of an aquifer being filled to the point that water overflows onto the land surface. Therefore, if enough water is pumped out of an aquifer it could possibly influence ground water discharge (springs and streams) by reducing, or perhaps stopping, streamflow. The lowermost pool in Agua Remora had reduced water depths in 2005 and nearly dried in 2007 and 2009; Zuni bluehead suckers were salvaged from this area and moved upstream to the middle pool or taken to the Albuquerque Bio Park for a rearing program (Carman 2008, p. 17; Carman 2009, p. 24). However, it is unknown whether this observed reduction in water depths is a product of groundwater pumping in the area, effects of climate change, or both.

Groundwater use in the range of the Zuni bluehead sucker is expected to increase due to human population expansion. In early 2007, a development company (Tampico Springs 3000, LLC), presented a preliminary plat to

McKinley County, New Mexico, for Tampico Springs Ranch Subdivision. The subdivision is located just northeast of currently occupied Zuni bluehead sucker habitat. The subdivision would have a total of 490 lots, varying from 1.2 to 4.8 hectares (ha) (3 to 11.9 acres (ac)), each with an individual well and septic system. An increase in the number of wells would affect aquifer drawdowns, and individual septic tanks could potentially lead to water quality concerns. The geohydrologic investigation report, prepared for Phase I of the subdivision, states that water withdrawal is likely to affect flow at Brennan and Tampico Springs (MJDarrconsult, Inc. 2007, p. 26). In January 2008, the plat for Phase I of the subdivision was approved by McKinley County with conditions, including metering of water wells to enforce the 0.3 acre-ft. per year per household restriction (Carman 2008, p. 17). Construction of Phase I has begun, with 17 of 45 lots sold (First United Realty 2012, p. 1).

In Arizona, existing water withdrawals throughout the Navajo Indian Reservation are generally for water haulers (people who collect water in tanks and transport it to another location for use); domestic and municipal use; water storage facilities; commercial, agricultural, mining and industry uses; recreation and wildlife; and wastewater management. Water withdrawals have been documented on the Navajo Indian Reservation for many years. Water levels in wells in the Black Mesa area have declined as much as 70 ft (21.3 m) since 1963 (Littin 1992, p. 1). As of 2003, there were 75 livestock wells on the Navajo Indian Reservation, in both alluvial (connected to the river) and deep-water aquifers (Navajo Nation Department of Water Resources 2003, p. 40). Additionally, water in Kinlichee Creek has been noted as very low in recent years (Kitcheyan and Mata 2012, p. 3), and Scattered Willow Wash, Black Soil Wash, and Kinlichee Creek have been intermittent several years in a row (Carman 2004, pp. 2, 8; Kitcheyan and Mata 2012, p. 3). These low-water events are exacerbated by continued water withdrawal in the region. Given past groundwater use and the likelihood of continued drought (see *Climate Change,* below), groundwater declines will likely continue into the future.

In summary, water withdrawals have affected the Zuni bluehead sucker rangewide in the past, resulting in dry streambeds or very low water levels in the lower Rio Nutria, Rio Pescado, Zuni River, and possibly in Agua Remora in New Mexico and in Scattered Willow Wash, and Kinlichee Creek in Arizona. Based on our review of the available information, we conclude that the effects of water withdrawal are a continuing threat to the Zuni bluehead sucker habitat across its range and as a result are negatively affecting the species.

Sedimentation

Sedimentation occurs when particles suspended in the water column fall out of suspension and cover the streambed, filling in spaces between substrate particles. Sedimentation results in the loss of suitable habitat and available food resources for Zuni bluehead sucker. Fine sediments, in particular, reduce or prevent production of algae, the Zuni bluehead sucker's primary food. Research has shown that heavy sediment loads have the potential to limit algae production by restricting light penetration or smothering (Graham 1990, pp. 107–109, 113–114; Wood and Armitage 1997, pp. 203, 209–210).

High concentrations of fine sediment have been found to affect fishes: (1) By adversely affecting fish swimming and either reducing their rate growth, tolerance to disease, or even resulting in death (Bruton 1985, p. 221); (2) by reducing the suitability of spawning habitat and hindering the development of fish eggs, larvae and juveniles are more susceptible to suspended solids than adult fish (Chapman 1988, p. 15; Moring 1982, p. 297); (3) by modifying the natural migration patterns of fish (Alabaster and Lloyd 1982, pp. 2–3); (4) by reducing the abundance of food available to fish due to a reduction in light penetration (Bruton 1985, p. 231; Gray and Ward 1982, pp. 177, 183); and (5) by affecting the efficiency of hunting, particularly in the case of visual feeders (Bruton 1985, p. 221, 225–226; Ryan 1991, p. 207). If mobilized during the spawning season, fine sediments may also smother and suffocate spawned eggs (Propst and Hobbes 1996, p. 39). The reproductive successes of fishes that require clean gravel substrate have been reduced by increased sedimentation due to smothering of eggs, which may be the case for Zuni bluehead sucker (Berkman and Rabeni 1987, p. 285; Propst and Hobbes 1996, p. 38). Increasing sedimentation in Agua Remora and Rio Nutria has led to the loss of optimal Zuni bluehead sucker habitat (permanent, clear flowing water over hard substrate). Sedimentation throughout the range of Zuni bluehead sucker is primarily caused by logging, livestock grazing, and road construction; these are discussed in detail below.

Logging

Many areas of the landscape where the Zuni bluehead resides have been impacted by past logging activities. For example, in the early 1890s, logging and presence of logging railroads were widespread within the Zuni Mountains, which supported several lumber towns (NRCS 1998, p. 17). Logging activities in the late-1800s likely caused major changes to the watershed; the Zuni Mountains were nearly void of ponderosa pine (*Pinus ponderosa*) during the railroad logging days (Dick-Peddie 1993, p. 68). The Mt. Taylor Ranger District identified the forest to be dominated with Ponderosa pine and small stands of Gambel oak (*Quercus gambelii*), stratified with mature stands of large conifers left over from railroad logging in the early 1900s, including younger and smaller trees, as well as saplings (Forest Service 2011, p. 19).

In general, logging activities have been well documented to impact watershed characteristics and stream morphology (Chamberlin *et al.* 1991, pp. 181–205; Ohmart 1996, p. 259). Tree removal along stream riparian zone likely alters water temperature regimes, sediment loading, bank stability, and availability of large woody debris (Chamberlin *et al.* 1991, pp. 181–205). Soil surface erosion from logging or logging activities is directly related to the amount of bare compacted areas exposed to rainfall and runoff, which then contributes large quantities of fine sediments to stream channels (Chamberlin *et al.* 1991, p. 193). Extensive clearcutting and overgrazing were the primary contributors to the reduction of the original riparian vegetation by 70 to 90 percent in the Zuni Mountains (Ohmart 1996, p. 259). Logging is actively practiced on both private and public lands within the Zuni watershed (NRCS 1998, p. 17). For example, in 2012, the Forest Service funded the Zuni Mountain Collaborative Forest Landscape Restoration project, which will increase logging to reduce fire risk in the Rio Puerco and Rio Nutria watersheds over the next 10 years (Forest Service 2012, pp. 1–2). Ultimately, the reduction in fire risk in these watersheds is likely to benefit the Zuni bluehead sucker; however, the short-term increase in logging is likely to increase sedimentation in these watersheds.

In summary, sedimentation from logging has historically affected Zuni bluehead sucker habitat rangewide, reducing the amount of suitable habitat. Logging rates have much reduced in recent years but will continue into the future, particularly in the Rio Puerco

and Rio Nutria watersheds over the next decade, which will likely contribute to the cumulative effect of sedimentation impacting the Zuni bluehead sucker habitat.

Livestock grazing

Livestock grazing has been one of the most widespread and long-term causes of adverse impacts to native fishes and their habitat (Miller 1961, pp. 394–395, 399; Platts 1991, pp. 389–423; Belsky *et al.* 1999, entire; Medina *et al.* 2005, pp. 9–98). Widespread livestock grazing and logging likely contributed to habitat modifications, resulting in severe degradation of the Zuni watershed (Hanson 1982, p. 14; NRCS 1998, p. 1; NMDGF 2004, p. 12). Livestock grazing has been shown to increase soil compaction, decrease water infiltration rates, increase runoff, change vegetative species composition, decrease riparian vegetation, increase stream sedimentation, increase stream water temperature, decrease fish populations, and change channel form (Meehan and Platts 1978, pp. 275–276; Kauffman and Krueger 1984, pp. 430–435; Schulz and Leininger 1990, p. 295; Platts 1991, pp. 393–403; Ohmart 1996, pp. 246–274). Although direct impacts to the riparian zone and stream can be the most obvious sign of livestock grazing, upland watershed condition influences the timing and amount of water delivered to stream channels (Ohmart 1996, pp. 260, 268). Increased soil compaction and decreased vegetative cover lead to faster delivery of water to stream channels, increased peak flows, and lower summer base flow (Platts 1991, p. 390; Ohmart 1996, p. 255; Belsky and Blumenthal 1997, pp. 321, 324). Consequently, streams are more likely to experience flood events during monsoon-like weather in summer (water runs off quickly instead of soaking into the ground) that negatively affects the riparian and aquatic habitats. Therefore, heavily grazed streams are more likely to become intermittent or dry in September and October, when groundwater recharge is reduced because water runs off quickly, rather than being absorbed by the soil (Ohmart 1996, p. 268).

Improper livestock grazing increases sedimentation through trampling of the steam banks and compacting soil, both of which can result in a reduction or elimination of riparian vegetation, which can be detrimental to stream habitat. Riparian vegetation insulates streams from temperature extremes in both summer and winter. Further, it filters sediment so that it does not enter the stream; sediment can lead to reduction or prevention of algal growth and smothering of newly spawned eggs (Propst and Hobbes 1996, p. 38). Riparian vegetation also provides a source of nutrients to the stream from leaf litter, which increases stream productivity, and it contributes root wads and large and small woody debris to the stream, which provide cover for the fish (Kauffman and Krueger 1984, pp. 430–431; Platts 1991, pp. 395–400; Ohmart 1996, pp. 247–249).

The Cibola National Forest (Forest) commissioned the Zuni Mountain Sucker Habitat Management Plan ''to protect, and to enhance, where possible, habitat of threatened and endangered species within the confines of the Forest'' (Winter 1979, p. 3). In 1978 and 1979, the Forest fenced off Agua Remora from grazing, which resulted in marked regrowth of the riparian area (Merkel 1979, p. 15; Stefferud 1985, p. 1). In 1988, the NMDGF Share with Wildlife program collaborated with the Forest to increase the fenced area, doubling the amount of protected habitat. However, the fence is occasionally in disrepair leading to unauthorized grazing in Agua Remora, and the fence is checked only if there is evidence of grazing within Agua Remora. A recent field trip to Agua Remora identified that the fence was in disrepair, and five cows were on the site; the riparian area had lost vegetative cover (Gilbert 2012, p. 1). Elk are also known to frequent this area as well (Gilbert and Carman 2011, p. 35). Additionally, several active grazing allotments are north of Agua Remora, with the closest being 2.4 km (1.5 mi) away; livestock grazing also occurs on nearby private land.

During the 1930s, in Arizona, on the Navajo Indian Reservation, nearly one million livestock (sheep, goats, horses, or cattle) ranged across the landscape, exposing soil and increasing erosion (Weisiger 2007, p. 440). Grazing continues today throughout the entire Navajo Indian Reservation, although herd numbers are much lower than in the 1930s. Although grazing has been reduced, the continuing drought has exacerbated effects of depleted forage, and the livestock numbers are considered to be overpopulated, (Davis 2012, p. 1). Additionally, cultural resistance to fencing on the Navajo Indian Reservation (Beatty Davis 1997, p. 49) creates a challenge for range management and stream protection. Direct access to streams and overgrazing by livestock on the Navajo Indian Reservation has been documented repeatedly (Sanchez 1975, p. 1, Service 1982, pp. 3–4; U.S. Army Corps of Engineers 1995, p. 3; Hobbes 2000, p. 14; NMDGF 2003, pp. 6, 13; David 2006, pp. 4, 20; Kitcheyan and Mata 2012, p. 3). Overall, both historical and current livestock grazing within the riparian zone and upland slopes has reduced vegetative cover and accelerated runoff and increased erosion in areas such as Tsaile Creek (Bureau of Reclamation 2011, p. 22).

In summary, Zuni bluehead sucker habitat near or adjacent to areas where livestock grazing occurs is significantly impacted. The resulting habitat degradation is a threat to the remaining Zuni bluehead sucker populations in New Mexico and Arizona. The available information indicates that these activities likely contributed to the reduction in riparian habitat, channel incision, and increased soil compaction, which resulted in unfavorable habitat conditions for Zuni bluehead sucker foraging or reproduction. Such unfavorable habitat conditions affect populations by reducing their viability. Based on our review of the available information, we conclude that the effects of livestock grazing are a threat to Zuni bluehead sucker habitat, and the species, throughout its entire range.

Road Construction

Roads increase surface runoff and sedimentation, which, in turn, increases turbidity, reduces primary production, and reduces numbers of aquatic insects (Burns 1972, p. 1; Eaglin and Hubert 1993, pp. 844–845). Roads require instream structures, such as culverts and bridges that remove aquatic habitat and can act as barriers to fish movement (Warren and Pardew 1998, p. 637). As seen with many other fishes and environments, all of these activities can negatively impact Zuni bluehead suckers and their habitat by lowering water quality, reducing the quality and quantity of pools by filling them with sediments, reducing the quantity of large woody debris necessary to form pools, and by imposing barriers to movement (Burns 1972, p. 1; Eaglin and Hubert 1993, pp. 844–845).

Vehicular use of roads in creek bottoms can degrade Zuni bluehead sucker habitat. Such use inhibits riparian plant growth, breaks down banks, causes erosion, causes sedimentation, and increases turbidity in the stream, particularly where vehicles drive through the stream (especially immediately downstream of the vehicular activity). These effects are likely to result in wider and shallower stream channels (Furniss *et al.* 1991, pp. 297–301). This change causes progressive adjustments in other variables of hydraulic geometry and results in changes to the configuration of pools, runs, riffles, and backwaters; levels of fine sediments and substrate

embeddedness (the degree to which rocks and cobble are stuck in the streambed); availability of instream cover; and other fish habitat requirements in the vicinity of vehicle crossings (Sullivan *et al.* 1987, pp. 67, 69–70; Rosgen 1994, p. 185). It also changes the way in which flood flows interact with the stream channel and may exacerbate flood damage to banks, channel bottoms, and riparian vegetation. Low-water crossings for vehicle use are seen throughout the Navajo Nation, where the stream channels are wider and shallower, embedded, and create barriers to fish movement (Service 2014b, pers. comm.).

Road construction activities may have direct adverse effects on the watershed from soil erosion and sedimentation to the streams. Past, current, and future road construction activities may ultimately increase the road density in a watershed. Road density is defined as the total kilometers (km) (miles (mi)) of road in a defined area in square kilometers (km^2) (square miles (mi^2)). Matthews (1999, p. 86) linked road densities to increased sediment yields in the Noyo River. Aerial photographs from 1935 and 1991 showed road density in the Cebolla and Rio Nutria watersheds rose 138 and 47 percent, respectively (NRCS 1998, pp. 42, 47). In 1991, the road density in Cebolla and Rio Nutria watersheds were more than 3.1 km/km^2 (4.9 mi/mi^2) and 4.5 km/km^2 (2.8 mi/mi^2), respectively (NRCS 1998, pp. 42, 47). In addition, the Zuni River Watershed Plan recommends that the road density for these watersheds should be 1.9 km/km^2 (3.1 mi/mi^2) and 2.9 km/km^2 (1.8 mi/mi^2), respectively, which both Cebolla and Rio Nutria watersheds exceeded in 1991 and probably continue to exceed today. The excessive miles of roads in this watershed was a concern in 1991, because of the increased erosion, loss of and fragmentation of wildlife habitat, and increased human–wildlife interaction (NRCS 1998, p. 67).

For example, Forest Road 50 in the upper watershed of Zuni bluehead sucker habitat (approximately 5 km (3 mi) away from the closest occupied habitat) was upgraded in 1999, and several roads were developed in 2007 for the Tampico Springs Subdivision. In 2011, the U.S. Forest Service issued an easement to McKinley County to upgrade Forest Road 191D with gravel surface material (Forest Service 2011, p. 1), which may increase vehicle traffic because residents may be able to access their property year round. This road is approximately 3 km (2 mi) from Agua Remora and 1.6 km (1 mi) from Tampico Spring (Forest Service 2011, pp. 31, 44).

On the Navajo Indian Reservation, past road construction continues to affect stream habitat. On Kinlichee Creek, for example, Bridge BR 280 constricts the channel considerably, which increases flow rates, channel scouring, and downstream deposition of sediment (U.S. Army Corps of Engineers 1995, p. 3). In addition, existing roads and bridges have ongoing maintenance requirements that result in alteration of stream channels within Zuni bluehead sucker habitat, as seen in other maintenance projects (Service 2011, pp. 3–5; Service 2012b, pp. 2–4). Sedimentation from road construction has occurred throughout the range of Zuni bluehead sucker in the past and is likely to continue in the future.

In summary, historical logging, overgrazing by livestock, and road construction have destroyed much of the groundcover across the Zuni bluehead sucker's range (Sanchez 1975, pp. 1, 4; Beatty Davis 1997, pp. 3, 7; NRCS 1998, p. 68), resulting in increased erosion, increased stream flow fluctuation, and the accumulation of large quantities of sediment throughout Zuni bluehead sucker habitat (Merkel 1979, p. 1). Livestock grazing and road construction are likely to continue at present rates throughout the species' range, and logging is likely to continue at reduced rates. Sedimentation results in depressed reproductive rates and inhibition of algal growth for food. Therefore, based on our review of the available information, we conclude that the effects of sedimentation are a threat to the Zuni bluehead sucker and its habitat rangewide.

Dams and Impoundments

Much of the primary water use from the Zuni River watershed is for irrigation of agriculture, livestock grazing, and human consumption. Many small impoundments, built primarily for watering livestock, partially prevent flows from reaching the mainstem rivers. According to Merkel (1979, p. 1), the lower Rio Nutria, Rio Pescado, and Zuni River watersheds have been drastically altered by human activities, such as the construction of many small impoundments for livestock watering. Reservoirs and diversion dams for irrigation have depleted stream flows below the dams and inundated stream reaches above the dams (Merkel 1979, p. 1; Hanson 1982, p. 4). Degradation of the upper watershed has led to increased sedimentation and many of the reservoirs are now only shallow, eutrophic (nutrient rich) ponds or wetlands with little or no storage capacity (NMDGF 2004, p. 20). Sediment trapping by these impoundments has also changed the character of the streams by altering channel morphology and substrate composition. The lower Rio Nutria was once a perennial stream with wide meanders bordered by willow and cottonwood (*Populus* spp.). After construction of impoundments in the Rio Nutria below the box canyon meanders, the channel became deeply incised with predominantly silt or silt-sand substrate, which is unsuitable for Zuni bluehead sucker. Flow is intermittent between the ephemeral pools and impoundments. Current habitat conditions are not favorable for Zuni bluehead sucker in much of the watershed downstream from the mouth of Rio Nutria Box Canyon, primarily due to impoundments, dams, and sedimentation from logging and grazing.

Additionally, beaver dams affect Zuni bluehead sucker habitat, particularly in New Mexico. In 2006, beaver activity in Tampico Draw and Rio Nutria increased greatly, fragmenting much Zuni bluehead sucker habitat (Carman 2007, p. 1). A marked decrease in captured Zuni bluehead sucker in Tampico Draw was attributed to increased siltation and water ponding due to beaver activity (Carman 2007, p. 1). In 2010, spring flows washed out the beaver dams in Tampico Draw, creating more suitable habitat for Zuni bluehead sucker (Gilbert and Carman 2011, p. 6). The best available information does not indicate beaver activity is affecting Zuni bluehead sucker populations in Arizona.

In summary, Zuni bluehead sucker habitat has been reduced rangewide due to impoundment construction. Impoundments have lasting effects on stream habitat both up and downstream, subsequently fragmenting fish populations and decreasing their resiliency and long-term persistence. Based on our review of the available information, we conclude that the effects of impoundments are a current threat to Zuni bluehead sucker and are having rangewide impacts on their habitat.

Housing Developments

Subdivision developments within the range of Zuni bluehead sucker would increase the amount of impervious surfaces in this watershed. Impervious surfaces are any surface material that prevents water from filtering into the soils, such as buildings, roads, sidewalks, patios, parking lots, and compacted soil (Brabec *et al.* 2002, p. 499, Coles *et al.* 2012, pp. 10, 107). An increase in the amount of impervious surfaces could increase the amount of runoff and decrease

infiltration rates. Impacts of urbanization on stormwater runoff leads to various stressors on spring systems, including increased frequency and magnitude of high flows in streams, increased sedimentation, increased contamination and toxicity, and changes in stream morphology and water chemistry (Coles *et al.* 2012, pp. 1–3, 24, 38, 50–51). Urbanization can also impact aquatic species by negatively affecting their invertebrate prey base (Coles *et al.* 2012, p. 4). The increased frequency and magnitude of water flowing to streams combined with pollutant sources, such as sediment, nutrients, fertilizers, and other contaminants, have been linked to changes in stream hydrology, stream habitat, and degradation of the stream's biological communities (Coles *et al.* 2012, p. 10). Urbanization can cause changes in fish population composition and distribution due to habitat changes and lower water table elevations due to groundwater use.

In 2011, the Forest granted an easement to McKinley County for access across Forest Service land via Forest Road 191D (Forest Service 2011 p. v). The granting of the right-of-way allows McKinley County to upgrade and assume maintenance of this road, which provides access to the upper Rio Nutria watershed. This road may facilitate the development of the Tampico Springs Ranch subdivision with potential groundwater loss in the watershed (Forest Service 2011, pp. ix, 31–33).

In summary, the increases in sedimentation and water withdrawals that could result from the development of additional phases of the subdivision are a threat to the Zuni bluehead sucker habitat in Rio Nutria and Tampico Springs, which constitutes the bulk of the species' distribution and habitat in New Mexico. As a result, future rural or urban developments can negatively affect habitat the species requires to survive and reproduce.

Wildfires

Wildfires can destroy vegetation along slopes and stream channels altering the physical properties of the soil. The lack of ground cover increases the amount of potential runoff, thereby increasing the amount of woody debris, sedimentation, and ash entering the stream (Swanston 1991, pp. 141, 175–177). Indirect effects, such as ash flow events that follow wildfire during monsoonal seasons can inundate Zuni bluehead sucker habitat, and smother and destroy eggs. Severe wildfires that extirpate fish populations are a relatively recent phenomenon and result from the cumulative effects of historical or ongoing overgrazing by domestic livestock, fire suppression, and climate change (Madany and West 1983, p. 666; Swetnam 1990, pp. 6–17; Touchan *et al.* 1995, p. 272; Swetnam and Baisan 1996, p. 28; Belsky and Blumenthal 1997, p. 318; Gresswell 1999, p. 212; Brown *et al.* 2004, p. 366; McKenzie *et al.* 2004, p. 898; Westerling *et al.* 2006, p. 943).

Historically, wildfires in the region were primarily cool-burning understory fires with fire return intervals of 4 to 8 years (Swetnam and Dieterich 1985, p. 395). Cooper (1960, p. 137) found that, prior to the 1950s, crown fires (intense fires that completely consume trees and move forward through tree canopies) were extremely rare or nonexistent in the region. Since the mid-1980s, wildfire frequency in western forests is nearly four times the average of 1970 to 1986, and the total area burned is more than 6.5 times the previous level (Westerling *et al.* 2006, p. 941). The average length of fire season increased by 78 days from the 1970 to 1986 period to the 1987 to 2003 period, and the average time between discovery and control increased from 7.5 days to 37.1 days for the same timeframes (Westerling *et al.* 2006, p. 941). McKenzie *et al.* (2004, p. 893) suggested, based on models, that the length of the fire season will likely increase further and that fires in the western United States will be more frequent and more severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming.

Changes in relative humidity, especially drying over the western United States, are also projected to increase the number of days of high fire danger (Brown *et al.* 2004, p. 365). Because Zuni bluehead sucker are found primarily in isolated, small headwater streams, they are unable to swim away from ash flows, and opportunities for natural recolonization are unlikely, due to the highly fragmented nature of Zuni bluehead sucker populations. Persistence of Zuni bluehead sucker in streams affected by fire and subsequent ash flows is unlikely in the Zuni watershed. The recently funded Zuni Mountain Collaborative Forest Landscape Restoration project is expected to reduce wildfire risk over 22,662 ha (56,000 ac) in the Rio Puerco and Rio Nutria watersheds (Forest Service 2012, p. 1). Currently, wildfire risk in this area is considered high (class III), but over the next decade this risk is expected to be reduced.

At this time, wildfire has the potential to affect Zuni bluehead suckers due to wildfire risk and associated impacts. Thus, wildfire is likely contributing to decreased viability of the species and causing the species to be at risk of extinction. However, the conservation efforts expected to be in place through the Zuni Mountain Collaborative Forest Landscape Restoration project may reduce the risk of catastrophic wildfire in the coming years. The best available information indicates that wildfire is a threat to the Zuni bluehead sucker.

Climate Change

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

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a, p. 30; and Solomon *et al.* 2007, pp. 35–54, 82–85). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is ''very likely'' (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007a, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al.* 2007, pp. 21–35). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of

natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl *et al.* 2007, entire; Ganguly *et al.* 2009, pp. 11555, 15558; Prinn *et al.* 2011, pp. 527, 529). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007a, pp. 44–45; Meehl *et al.* 2007, pp. 760–764, 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529). (See IPCC 2007b, p. 8, for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation. Also, see IPCC 2011 (entire) for a summary of observations and projections of extreme climate events.)

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007b, pp. 8–14, 18–19). Identifying likely effects often involves aspects of climate change vulnerability analysis. Vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, magnitude, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a, p. 89; see also Glick *et al.* 2011, pp. 19–22). There is no single method for conducting such analyses that applies to all situations (Glick *et al.* 2011, p. 3). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

As is the case with all stressors that we assess, even if we conclude that a species is currently affected or is likely to be affected in a negative way by one or more climate-related impacts, it does not necessarily follow that the species meets the definition of an ''endangered species'' or a ''threatened species'' under the Act. If a species is listed as endangered or threatened, knowledge regarding the vulnerability of the species to, and known or anticipated impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (e.g., IPCC 2007a, pp. 8–12). Therefore, we use ''downscaled'' projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (see Glick *et al.* 2011, pp. 58–61, for a discussion of downscaling). With regard to our analysis for the Zuni bluehead sucker, downscaled projections are available.

Climate simulations of Palmer Drought Severity Index (PSDI) (a calculation of the cumulative effects of precipitation and temperature on surface moisture balance) for the Southwest for the periods of 2006–2030 and 2035–2060 predict an increase in drought severity with surface warming. Additionally, drought still increases during wetter simulations because of the effect of heat-related moisture loss (Hoerling and Eischeid 2007, p. 19). Annual mean precipitation is likely to decrease in the Southwest as well as the length of snow season and snow depth (IPCC 2007b, p. 887). Most models project a widespread decrease in snow depth in the Rocky Mountains and earlier snowmelt (IPCC 2007b, p. 891). Exactly how climate change will affect precipitation is less certain, because precipitation predictions are based on continental-scale general circulation models that do not yet account for land use and land cover change effects on climate or regional phenomena. Consistent with recent observations in changes from climate, the outlook presented for the Southwest predicts warmer, drier, drought-like conditions (Seager *et al.* 2007, p. 1181; Hoerling and Eischeid 2007, p. 19). A decline in water resources will be a significant factor in the compromised watersheds of the desert southwest.

Climate change could affect the Zuni bluehead sucker through increased temperatures, evaporation, and probability of long-term drought. However, we are not able to predict with certainty how the indirect effects of climate change will affect Zuni bluehead sucker habitats due to a lack of information on the groundwater system that provides water to the species' spring-fed habitat and large-scale projections of precipitation that contribute to stream flow. We conclude that climate change may be a significant stressor that indirectly exacerbates existing threats by increasing the likelihood of prolonged drought that would reduce water availability for streamflow or spring flow and incur future habitat loss. The National Integrated Drought Information System (2012) classifies drought in increasing severity categories from abnormally dry, to moderate, severe, extreme, and, most severe, exceptional. The southwestern United States is currently experiencing drought conditions classified as moderate to exceptional. Drought conditions are reported as severe to extreme for areas occupied by Zuni bluehead sucker in Arizona and New Mexico (National Integrated Drought Information System 2012).

While Zuni bluehead sucker have survived many droughts in its evolutionary history, the present status of this species and its habitat is so degraded that the effects of the drought may be more difficult for the species to withstand. In some areas of Zuni bluehead sucker habitat, drought results in lower streamflow or pool habitat, with consequently warmer water temperatures and more crowded habitats with potentially higher levels of predation and competition. In other areas drought reduces flooding, which would normally rejuvenate habitat and tend to reduce populations of some nonnative species, which are less adapted to the large floods of Southwest streams (Minckley and Meffe 1987, pp. 93–104; Stefferud and Rinne 1996, p. 93). As such, long-term and recurrent drought, because of climate change, may affect Zuni bluehead sucker habitat, but the severity of the threat and impacts remains uncertain. Therefore, we conclude that long-term drought, because of climate change, is a threat to the Zuni bluehead sucker, and will likely continue to be a threat in the future. In addition, the impacts from climate change will likely exacerbate

the current and ongoing threat of habitat loss caused by other factors, as discussed above.

Summary of Factor A

The Zuni bluehead sucker faces a variety of threats throughout its range in Arizona and New Mexico, including water withdrawals, logging, livestock grazing, water impoundments, road construction, subdivision development, and long-term drought. In New Mexico, water withdrawals, subdivision development, livestock grazing, road construction, logging, and drought threaten Zuni bluehead suckers and their habitat. In Arizona, water withdrawals, livestock grazing, road construction, and drought have affected the Zuni bluehead sucker. These activities, alone and in combination, contribute to the substantial loss and degradation of habitat in Arizona and New Mexico.

The changes in the flow regimes and loss of habitat from water withdrawals, sedimentation, and impoundments have reduced and eliminated populations of Zuni bluehead sucker in both New Mexico and Arizona. These conditions, in combination with the predicted worsening drought conditions due to climate change, will continue to degrade and eliminate Zuni bluehead sucker habitat.

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

The Zuni bluehead sucker is not a game fish and does not have recreational or commercial value. Both the AGFD and NMDGF prohibit collection of the species (NMDGF 1998, p. 11; AGFD 2011, p. 6), although collection of Zuni bluehead sucker may be authorized by either State by special permit. A limited amount of scientific collection occurs but does not pose a threat to Zuni bluehead sucker because it is regulated appropriately by the States. However, we do not have any evidence suggesting that the occasional removal of Zuni bluehead sucker in this manner is a threat to the species.

Factor C. Disease or Predation

Disease

In general, fish species are susceptible to a spectrum of diseases, and the Zuni bluehead sucker is no exception. Diseases could potentially impact the reproduction, growth, and survival of the Zuni bluehead sucker. In addition, drought conditions (discussed above) may cause physiological stress on Zuni bluehead sucker making them more susceptible to disease. There is no published information on diseases of the Zuni bluehead sucker, although information is available from the Little Colorado River and the neighboring Lower San Juan River watershed for similar species. Asian tapeworm (*Bothriocephalus acheilognathi*) and anchor worm (*Lernaea cyprinacea*) have been found in the San Juan River system, but neither was found to infest bluehead suckers (Landye *et al.* 1999, p. 6). In addition, Landye *et al.* (1999, p. 7) also detected the protozoan *Ichthyophthirius multifilis,* but it was not found to affect bluehead suckers.

Although the best scientific information available does not indicate that disease is currently affecting the Zuni bluehead sucker, two parasites discussed below have been documented on the Zuni bluehead sucker and may be impacting the subspecies. Parasites are thought to decrease the growth rate of otherwise healthy fish and may lead to stress and possibly death (AGFD 2006, p. 40). Black grub, also called black spot (*Neascus* spp.) is a parasitic larval fluke that appears as black spots on the body of a fish. Adult black grub trematodes live in a bird's mouth and produce eggs, which are swallowed unharmed and released into the water in the bird's feces. Eggs mature in the water, hatch, and infest mollusks as an intermediate host. They then migrate into the tissues of a second intermediate host, which is typically a fish. When the larvae penetrate and migrate into the tissues of a fish, they cause damage and possibly hemorrhaging. The larvae then become encapsulated by host tissue and appear as black spots. The damage caused by one individual black grub is negligible, but in great numbers they may kill a fish (Lane and Morris 2000, pp. 2–3; Quist *et al.* 2007, p. 130). Black grub was found on several Zuni bluehead suckers in 2005 in the Rio Nutria Box Canyon area (Carman 2006, p. 8). None were seen on fish caught in 2006 or 2007, but black grub was observed again in the Rio Nutria Box Canyon in 2008 and Agua Remora in 2008 through 2012 (Carman 2009, p. 9; Gilbert and Carman 2011, p. 17, NMDGF 2013, p. 22). Because surveys have been intermittent in recent years, no information is available on whether black grub is present within occupied habitats of Zuni bluehead sucker in Arizona on the Navajo Indian Reservation, but black grub does occur within the Little Colorado River and Lower San Juan River watershed (Hobbes 2001a, pp. 38–39). Surveys on Navajo Nation were conducted in 2012, and black grub was not observed within occupied habitats of Zuni bluehead sucker.

Results from investigations on the effects of black grub on other species of fish have varied; effects have ranged from none, to slowing growth, to mortality (Hunter and Hunter 1938, pp. 480–481; Vinikour 1977, pp. 83, 88; Lemly and Esch 1984, pp. 475, 488–490; Quist *et al.* 2007, p. 130). Vinikour (1977, pp. 83, 88) found no effect on longnose dace (*Rhinichthys cataractae*) between populations that were infested with black grub and non-infested population. However, Hunter and Hunter (1938, pp. 480–481) showed that young black bass (*Micropterus dolomieu*) with heavy infestation of black grub lost weight. Young bluegill (*Lepomis macrochirus*) died due to black grub infestation (Lemly and Esch 1984, pp. 475, 488–490). The effects of black grub on the Zuni bluehead sucker are unknown.

Yellow grub is a parasitic, larval flatworm that appears as yellow spots on the body and fins of a fish. These spots contain larvae of worms that are typically introduced by fish-eating birds that ingest fish infected with the parasite. Once ingested, the parasites mature and produce eggs in the intestines of the bird host. The eggs are then deposited into water bodies in the bird waste, where they infect the livers of aquatic snails. The snail hosts in turn allow the parasites to develop into a second and third larval form, which then migrates into a fish host. Because the intermediate host is a bird and, therefore, highly mobile, yellow grub are easily spread. When yellow grubs infect a fish, they penetrate the skin and migrate into its tissues, causing damage and potentially hemorrhaging. Damage from one yellow grub may be minimal, but, in greater numbers, yellow grub can harm or kill fish (Lane and Morris 2000, p. 3). Yellow grub was first observed in Zuni bluehead suckers in Black Soil Springs in 2012, and again in 2013 (Kitcheyan 2012, p. 1, Kitcheyan 2013, p. 1). The effects of yellow grub on the Zuni bluehead sucker are unknown.

The available information does not indicate disease is a threat to the Zuni bluehead sucker rangewide. However, both black and yellow grub may be a threat to the species; these parasites have profound effects on many other species of fish, and both have been detected in Zuni bluehead sucker. The best available information indicates that it could be a threat and additional sampling and studies are needed. We request information on any potential threat to the Zuni bluehead sucker posed by black grub or other parasites or disease.

Predation

The introduction and spread of nonnative species has been identified as one of the primary factors in the continuing decline of native fishes throughout North America and particularly in the southwestern United States (Miller 1961, pp. 365, 397–398; Lachner *et al.* 1970, p. 21; Ono *et al.* 1983, pp. 90–91; Carlson and Muth 1989, pp. 222, 234; Fuller *et al.* 1999, p. 1; Propst *et al.* 2008, pp. 1246–1251; Pilger *et al.* 2010, pp. 300, 311–312). Nonnative fish and crayfish are found throughout the range of the Zuni bluehead sucker.

Nonnative fishes known to occur within the historical range of the Zuni bluehead sucker include channel catfish (*Ictalurus punctatus*), fathead minnow, green sunfish, plains killifish (*Fundulus zebrinus*), largemouth bass (*Micropterus salmoides*), rainbow trout, cutthroat trout (*Oncorhynchus clarkii*), northern pike, brown trout (*Salmo trutta*), grass carp (*Ctenopharyngodon idella*), and goldfish (*Carassius auratus*) (NMDGF 2003, pp. 2–14; NMDGF 2004, p. 10; David 2006, pp. 7–15). In particular, nonnative predatory fishes (primarily green sunfish) have contributed to the displacement or elimination of the species from portions of its historical range (NMDGF 2004, p. 24). Predation by green sunfish upon native fishes within the Colorado River watershed has been well-documented (Marsh and Langhorst 1988, p. 65; Lohr and Fausch 1996, p. 155; Dudley and Matter 2000, pp. 24, 27–28; Tyus and Saunders 2000, p. 19). Propst *et al.* (2001, p. 162) documented few or no Zuni bluehead suckers in areas occupied by green sunfish. The rarity of small Zuni bluehead suckers in Agua Remora may be due to green sunfish predation on young Zuni bluehead sucker, limiting recruitment (Marsh and Langhorst 1988, p. 65; Carman 2008, p. 17). In 2006, green sunfish dominated the catch in Agua Remora (Carman 2007, p. 7), but since that time, dedicated eradication efforts have led to a significant decline in green sunfish numbers, and larval Zuni bluehead suckers were observed in 2009 (Gilbert and Carman 2011, p. 17), indicating the population was responding positively to the reduced numbers of green sunfish. The Zuni bluehead sucker occurs only in stream and spring habitats that are comparatively free of nonnative fishes (Propst and Hobbes 1996, p. 37; Carman 2009, p. 20).

Two species of nonnative crayfish have been documented in the lower Colorado River watershed: The northern crayfish and red swamp crayfish (Childs 1999, p. 5). Crayfish can affect aquatic systems because they are opportunistic omnivores (eating both animals and plants) (Carpenter 2005, p. 335). Many studies have demonstrated that introduced crayfish prey upon native fishes and compete with them for shelter (Rahel and Stein 1988, p. 94; Rahel 1989, p. 301; Bryan *et al.* 2002, pp. 49, 55–56; Carpenter 2005, pp. 5, 339). Crayfish are known to eat fish eggs, especially those bound to the substrate (Dorn and Mittelbach 2004, p. 2135), like those of the Zuni bluehead sucker. In addition, Thomas and Taylor (2013, p. 1315) suggest that crayfish may have negative effects on adult benthic fish populations and that predation is a possible mechanism. The Thomas and Taylor (2013, p. 1313) study was based on darters (*Etheostoma* sp.) where fish being consumed were on average 44.3 millimeters (1.74 in). Based on this study, the size of fish being consumed by crayfish could be indicative that young bluehead sucker may be consumed by crayfish as well, therefore, posing a threat to young Zuni bluehead suckers.

The northern crayfish was detected in the Zuni River confluence with the Rio Pescado, in the Rio Pescado itself, and in the lower end of Rio Nutria in 2000, 2001, and 2004, respectively (NMDGF 2004, p. 5; Carman 2009, p. 20). The northern crayfish is also present at occupied sites of Zuni bluehead sucker on the Navajo Indian Reservation in Black Soil Wash (Carman 2004, p. 4; Kitcheyan and Mata 2012, p. 2) and Kinlichee Creek (Kitcheyan and Mata 2012, p. 2). The northern crayfish is tolerant of a wide range of habitats and may be a threat to Zuni bluehead sucker through competition or predation.

Nonnative fish and crayfish occur throughout the range of the Zuni bluehead sucker, and in Agua Remora the dominance of green sunfish appears to be the cause of limited recruitment and population decline. Given the widespread occurrence of green sunfish and other nonnative predators across the range of the Zuni bluehead sucker and the low Zuni bluehead sucker population numbers rangewide, we conclude that predation is a threat to the Zuni bluehead sucker.

Conservation Efforts To Reduce Disease or Predation

As stated above, NMDGF has begun a green sunfish eradication effort at Agua Remora, which has significantly lowered the green sunfish population there, such that larval Zuni bluehead sucker were observed after implementation of this program after several years of absence.

Summary of Factor C

In summary, black grub has been documented throughout the range of the species and is known to adversely affect or kill fish. In addition, nonnative predatory fish, particularly green sunfish, have contributed to the displacement or elimination of the species throughout its range, and nonnative crayfish are likely preying upon Zuni bluehead sucker eggs. Therefore, we conclude that parasites may be a threat to the Zuni bluehead sucker, and predation is a documented threat to the species. These threats are already occurring; they affect the species throughout its range; and they result in the reduced viability of the species because of the reduced range and low population numbers rangewide.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the Zuni bluehead sucker discussed under other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species. . . .'' In relation to Factor D under the Act, we interpret this language to require the Service to consider relevant Federal, State, and Tribal laws, regulations, and other such mechanisms that may minimize any of the threats we describe in threat analyses under the other four factors, or otherwise enhance conservation of the species. We give strongest weight to statutes and their implementing regulations and to management direction that stems from those laws and regulations. An example would be State governmental actions enforced under a State statute or constitution, or Federal action under statute.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may reduce or eliminate the impacts from one or more identified threats. In this section, we review existing State and Federal regulatory mechanisms to determine whether they effectively reduce or remove threats to the Zuni bluehead sucker.

Existing mechanisms that could provide some protection for the Zuni bluehead sucker include: (1) New Mexico Wildlife Conservation Act; (2)

New Mexico Zuni bluehead sucker recovery plan; (3) Wildlife of Special Concern Act in Arizona; (4) National Environmental Policy Act (NEPA); (5) National Forest Management Act; and (6) Zuni Pueblo Law and Order Code.

State Regulations

New Mexico State law provides limited protection to the Zuni bluehead sucker. The species is listed in New Mexico as threatened, Group 2 (= threatened) in 1975, which are those species ''whose prospects of survival or recruitment within the state are likely to become jeopardized in the near future'' (NMDGF 1988, p. 1; Bison-M 2012). The species legal status designation was upgraded to a Group 1 (= endangered), which are those species ''whose prospects of survival or recruitment within the state are in jeopardy'' (NMDGF 1988, p. 1; NMDGF 1990, pp. 1, 3; Bison-M 2012, p. 4). This designation provides protection under the New Mexico Wildlife Conservation Act of 1974 (the State's endangered species act) (19 NMAC 33.6.8), but it only prohibits direct take of this species, except under issuance of a scientific collecting permit. A limited amount of scientific collection occurs but does not pose a threat to Zuni bluehead sucker because it is regulated appropriately by the State. The New Mexico Wildlife Conservation Act defines ''take'' or ''taking'' as ''harass, hunt, capture, or kill any wildlife or attempt to do so'' (17 NMAC 17.2.38). In other words, New Mexico State status as an endangered species conveys protection from collection or intentional harm to the animals themselves but does not provide habitat protection. Penalties for violations may result in fines up to $1,000 and imprisonment up to 1 year. New Mexico State statutes do not address habitat protection, indirect effects, or other threats to the species. New Mexico State status as an endangered species only conveys protection from collection or intentional harm. However, no formal consultation process addresses the habitat requirements of the species or how a proposed action may affect the needs of the species. Because most of the threats to the species are from effects to habitat, protecting individuals will not ensure their long-term protection.

NMDGF recognizes the importance of the Zuni bluehead sucker conservation at the local population level and has the authority to consider and recommend actions to mitigate potential adverse effects to this species during its review of development proposals. As noted, NMDGF's primary regulatory venue is under the New Mexico Wildlife Conservation Act. There are no provisions beyond those ''take'' provisions described above requiring other State agencies to adopt the recommended mitigation measures.

Still, as directed by the Wildlife Conservation Act amendments of 1995, NMDGF were responsible for developing recovery plans for species listed as endangered by the State (17–2–40.1 NMSA 1978). Thus, the NMDGF developed a recovery plan for the Zuni bluehead sucker in 2004 (NMDGF 2004, entire). The objective of the recovery plan is that, by 2015, the populations and distribution of the Zuni bluehead sucker are sufficient to ensure its persistence within New Mexico and thereby warrant its removal from the State endangered species list. The recovery plan does not restrict activities that would be likely to adversely affect the species or its habitat and, likewise, does not require activities that would be likely to benefit the species or its habitat; however, the recovery plan and implementation has vital information on the Zuni bluehead sucker. As noted above, the State's recovery plan does not ensure any long-term protection for the Zuni bluehead sucker because there are no mandatory elements or funding dedicated to ensure the recovery plan is implemented. In addition, much of the current and historical range of the Zuni bluehead sucker occurs on the Zuni Pueblo. The State of New Mexico recognizes the Zuni Pueblo as a sovereign nation and as such, does not have jurisdiction over wildlife species on Zuni Pueblo. Therefore, NMDGF does not have the authorization to restrict proposed projects that may adversely affect these species or their habitat.

The Wildlife of Special Concern Act in Arizona lists the Zuni bluehead sucker as a candidate species (AGFD 1996, p. 8). Candidate species are those species or subspecies for which threats are known or suspected but for which substantial population declines from historical levels have not been documented (though they appear likely to have occurred) (AGFD 1996, p. 8). The listing under the State of Arizona law does not provide protection to the species or their habitats. In 2007, AGFD identified the Zuni bluehead sucker in fishing regulations as a State-protected native fish that may not be possessed; however, this status still lacks habitat protection (AGFD 2007, p. 1). Penalties for violations result in a fine.

In Arizona and New Mexico the Zuni bluehead sucker is classified as a Species of Greatest Conservation Need (SCGN) (AGFD 2006, p. 154; NMDGF 2006, p. 54). New Mexico's SGCN are associated with key habitats and include low and declining populations and species of high recreational, economic, or charismatic value (NMDGF 2006, p. 8). No regulatory protections are afforded based on this designation. Because there are no provisions for habitat conservation in either State's law, the existing New Mexico Wildlife Conservation Act and the Arizona Wildlife of Special Concern Act do not address the threat of nonnative species in the habitat of the Zuni bluehead sucker.

In addition, in 2006, the AGFD developed an Arizona statewide conservation agreement for roundtail chub (*Gila robusta*), headwater chub (*Gila nigra*), flannelmouth sucker (*Catostomus latipinnis*), Little Colorado River sucker (*Catostomus* spp.), bluehead sucker, and Zuni bluehead sucker. The stated objective of this 5-year agreement is to address and ameliorate the five listing factors found in section 4(a)(1) of the Act. Signatories to the agreement include the Bureau of Reclamation, Hualapai Tribe, Salt River Project, Bureau of Land Management, Arizona State Land Department, Arizona Department of Water Resources, The Nature Conservancy, Forest Service, and AGFD. The agreement establishes a general framework for cooperation and participation among signatories. The parties have agreed that a suite of actions should be implemented to achieve the stated objective; examples of these actions in the agreement that may benefit Zuni bluehead sucker include establishing and maintaining a database of information on the species, restoring natural fire regimes in the watersheds of extant populations of species, and maintaining habitat quality. Activities conducted under this agreement have provided vital information on the Zuni bluehead sucker. In Arizona, all of the current and historical range of the Zuni bluehead sucker occurs on Navajo Nation lands; however, Navajo Nation is not a signatory on the conservation agreement and, thus, actions outlined in the agreement do not apply to these Tribal lands. Navajo Nation has expressed interest in becoming a signatory to this AGFD conservation agreement, but they have not been involved in the agreement's implementation. The State of Arizona recognizes Navajo Nation as a sovereign nation and, as such, does not have jurisdiction over wildlife species on the Navajo Nation lands. The agreement was scheduled to last a minimum of 5 years and is, therefore, currently outdated, but all signatories have expressed interest in updating the

agreement. Much like the New Mexico recovery plan, the Arizona statewide conservation agreement is not regulatory in nature and does not restrict activities that may adversely affect the species or its habitat. In addition, specific future efforts need to implement the conservation agreement have not been identified.

Both AGFD and NMDGF are State agency signatories to the ''Rangewide conservation agreement and strategy for roundtail chub, bluehead sucker, and flannelmouth sucker'' (Colorado River Fish and Wildlife Council 2006, p. 6). The agreement, known as the three species conservation agreement, was developed to expedite implementation of conservation measures for roundtail chub, bluehead sucker, and flannelmouth sucker. The stated goal of the agreement is to ensure the persistence of roundtail chub, bluehead sucker, and flannelmouth sucker populations throughout their ranges. This agreement may incidentally reduce threats to the Zuni bluehead sucker, but the subspecies is not the focus of the agreement. Examples of conservation actions identified in the agreement and strategy include: Conducting status assessments of the three subject species; establishing and maintaining a database of information on the three subject species; and genetically and morphologically characterizing populations of the three species. The agreement and its implementation provide vital information on the Zuni bluehead sucker. However, as stated for the State agencies' conservation agreements and recovery plan, this agreement is not regulatory in nature and does not specifically restrict activities that may adversely affect the species or its habitat.

The Policy for Evaluation of Conservation Efforts (PECE) provides guidance for the evaluation of conservation efforts when making a listing decision. The policy applies to conservation efforts identified in conservation agreements, conservation plans, management plans, or similar documents approved by Federal agencies, State and local governments, Tribal governments, businesses, organizations, or individuals. Further, for the purpose of PECE, conservation efforts are defined as specific actions, activities, or programs designed to eliminate or reduce threats or otherwise improve the status of a species. Conservation efforts may involve restoration, enhancement, maintenance, or protection of habitat; reduction of mortality or injury; or other beneficial actions. We are not conducting an analysis under PECE for the Zuni bluehead sucker recovery plan developed by NMDGF, the AGFD statewide conservation agreement, or the rangewide conservation agreement and strategy because these plans do not provide detailed conservation strategies designed to eliminate or reduce threats to the Zuni bluehead sucker. Parties to the agreements are not committing themselves to any specific efforts under a timeline or implementation schedule; rather, the agreement and recovery plan include broad strategies that may be employed in the future to achieve their intended objectives of precluding the need to list the species. These conservation efforts within the plans and agreements lack the necessary specificity that would be required in order for us to consider them under PECE. The plans are nevertheless valuable because they generate useful information, and some actions have been completed under them; however, specific future actions are not described in a level of detail that suggests evaluation under PECE would be appropriate.

As discussed above (see Factor C. Disease or Predation), the introduction and spread of nonnative aquatic species is a threat to Zuni bluehead sucker. The existing regulatory mechanisms in Arizona and New Mexico do not protect the Zuni bluehead sucker from nonnative aquatic predators. Regulation of programs to introduce, augment, spread, or permit such actions do not address the spread of nonnative species, as many nonnative species introductions are conducted through incidental or unregulated actions.

We also searched for State laws or local ordinances that would include provisions for instream water rights to protect fish and wildlife and their habitat. New Mexico water rights are regulated by the Interstate Stream Commission and the Office of State Engineer for surface and groundwater; New Mexico State law does not allow for instream flows for fish and wildlife. Instream flows for fish and wildlife (*i.e.,* water is not diverted for irrigation but remains in the river to ensure permanent flows) are allowed under Arizona water law; however, this is a relatively recent provision, and instream water rights have low priority and are often overcome by more senior diversion rights. Arizona State law also allows groundwater pumping via a permit process administered by the Arizona Department of Water Resources. As discussed above (see the above discussion on water withdrawals under *Factor A*), despite this regulation, groundwater withdrawals have resulted in reduced surface flow in Zuni bluehead sucker habitat. Therefore, the Arizona State law does not adequately protect Zuni bluehead sucker habitat.

Federal Regulations

Many Federal statutes potentially afford protection to Zuni bluehead sucker. A few of these are the Federal Land Policy and Management Act (43 U.S.C. 1701–1782), the National Forest Management Act (16 U.S.C. 1600 *et seq.*), and the Federal Water Pollution Control Act (Clean Water Act (33 U.S.C. 1251 *et seq.*)). However, in practice, the provisions of these statutes that require consideration of rare species have not been able to address the threats to the Zuni bluehead sucker.

The Federal Land Policy and Management Act and National Forest Management Act provide mechanisms for protection and enhancement of Zuni bluehead sucker and its habitat on Federal lands. The only Zuni bluehead sucker population on Federal land is in Agua Remora, on the Cibola National Forest. The National Forest Management Act requires the Forest Service to prepare management plans for each National Forest; a plan has been completed for the Cibola National Forest (Forest Service 1985, pp. 17–18). Forest plans must meet the requirements of the Natural Resources Multiple-Use Act to address such issues as recreation, range, timber, biological diversity, and economic and social factors in agency decisionmaking. The 1985 Cibola National Forest Plan includes a discussion of protection of the Zuni bluehead sucker. The plan indicated that fencing would protect Zuni bluehead sucker riparian habitat, but improved range management was needed to restore the entire watershed. The Forest Service has made minor progress in protecting the habitat at Agua Remora by fencing the area to prevent grazing, but as discussed above, fencing has not been completely effective due to inadequate maintenance of the fences. Continued monitoring and maintenance of this fence is necessary to provide sufficient protection to the Zuni bluehead sucker population in Agua Remora from the effects of livestock grazing.

In addition, the Zuni bluehead sucker is listed as a sensitive species for the Forest Service's Southwestern Region, which includes Arizona and New Mexico (Forest Service 2007, p. 22). The Forest Service intends to develop and implement management practices to ensure that designated sensitive species do not become threatened or endangered because of Forest Service actions. Essentially, sensitive species must receive special management

considerations or protection by the Forest Service to ensure their viability to preclude trends toward endangerment that would result in the need for Federal listing. While the Forest Service has attempted fencing at Agua Remora to eliminate the threat of livestock grazing, a number of other threats to the population at Agua Remora are beyond the Forest Service's control; namely, water levels have been extremely low in recent years, and in the absence of removals by NMDGF, green sunfish affect Zuni bluehead sucker recruitment.

Section 404 of the Clean Water Act regulates placement of fill into waters of the United States, including most of Zuni bluehead sucker habitat. However, many actions highly detrimental to Zuni bluehead sucker and its habitat, such as irrigation diversion, structure construction and maintenance, and livestock grazing are often exempted from the Clean Water Act. Other detrimental actions, such as bank stabilization and road crossings, are covered under nationwide permits that receive little or no Service review. A lack of thorough, site-specific analyses for projects can allow substantial adverse effects to Zuni bluehead sucker and its habitat.

Tribal Regulations

Zuni Pueblo—The Zuni bluehead sucker, speckled dace, and grass carp are protected from fishing in Zuni Pueblo lakes (Zuni Pueblo Law and Order Code S7–5–3 paragraph 36). In addition, stream fishing is prohibited on the Pueblo. These regulations protect the species from take by fishing but do not protect Zuni bluehead sucker habitat or prevent take from sources other than fishing, such as water withdrawals and livestock grazing.

Navajo Nation—The Zuni bluehead sucker is not protected within the Navajo Indian Reservation. The Navajo Nation Endangered Species List classifies the bluehead sucker as a whole as a Group 4 (G4) species. G4 species are candidates and include those species or subspecies for which the Navajo Fish and Wildlife Department does not have sufficient information to support endangered (Group 2) or threatened (Group 3) status but has reason to consider them (Navajo Nation Heritage Program 2008, pp. i, iv, vi, 84, Navajo Nation 2013, p. 2). The bluehead sucker is not protected by the Navajo Nation because it is not considered threatened or endangered.

Navajo Nation has several plans and policies that potentially afford protection to the Zuni bluehead sucker. A few of these are the Biological Resources Land Use Clearance Policies and Procedures, Navajo Nation Water Quality Standards of 2007, Navajo Nation Aquatic Resources Protection Program, and Navajo Nation's 10–Year Forest Management Plan.

The Biological Resources Land Use Clearance Policies and Procedures (RCP) categorizes the Navajo Nation into six categories of sensitivity, ranging from High Sensitivity, Moderate Sensitivity, Low Sensitivity, Community Development Areas, Recreation Areas, and Biological Preserves (Navajo Nation 2008a, pp. 1–2). The Highly Sensitive Areas (Area 1) and Biological Preserves are areas that are the most protected on the Nation's land (Navajo Nation 2008a, p. 4). All of the watersheds that are proposed for critical habitat for the Zuni bluehead suckers are within Highly Sensitive Areas. The RCP outlines the policies and procedures required for any projects to occur within highly sensitive areas (Navajo Nation 2008a, entire). Area 1 is considered Highly Sensitive; contains the best habitat available for endangered and rare plant, animal, and game species; and has the highest concentration of these species on the Navajo Nation. The purpose of this area is to protect these valuable and sensitive biological resources to the maximum extent practical. The general rule for this area is no activity or development can occur that is going to result in significant impact to wildlife resources.

The Navajo Nation Water Quality Standard of 2007 includes regulations that establish surface water quality standards applicable to the surface waters of the Navajo Nation pursuant to the Federal Clean Water Act. The purpose of the surface water quality standards is to protect, maintain, and improve the quality of Navajo Nation surface waters for public and private drinking water supplies; to promote the habitation, growth, and propagation of native and other desirable aquatic plant and animal life; to protect existing, and future, domestic, cultural, agricultural, recreational and industrial uses; and to protect any other existing and future beneficial uses of Navajo Nation surface waters (Navajo Nation 2008b, p. 1). This is equivalent to the Clean Water Act, and the inadequacy of Clean Water Act protections described above would apply similarly to the Navajo Nation Water Quality Standard of 2007.

The Navajo Nation Aquatic Resource Protection Program, established in March 1994, establishes regulatory standards for protection of rivers, streams, lakes, wetlands, riparian areas, and other sensitive aquatic features on Navajo lands. The goal of the Navajo Nation Aquatic Protection Program is to provide for the protection, preservation, and enhancement of all aquatic resources, associated habitats, and wildlife that are vital to the continued survival and well-being of the people of the Navajo Nation. The program regulates development and alterations to sensitive areas. This document classifies and lists levels of protection for riparian corridors, wetlands, lakes and streams; development standards are established for the various areas; and management practices were developed to mitigate impacts to the aquatic resources. This program requires any development within sensitive areas to be evaluated, and some protection for the Zuni bluehead sucker and its habitat may be provided through this review process. However, this would protect against future development and not provide protection from other threats to the species.

The Navajo Nation has a 10-Year Forest Management Plan (FMP). The purpose of the FMP is to establish forest management direction for the Defiance Plateau-Chuska Mountains, which include commercial timberland. The Forest Management Plan designates Special Management Areas, which were recommended to create favorable wildlife habitat and to benefit threatened and endangered species, water, soil, recreation, and traditional/cultural resources (Navajo Nation 2000, pp. i, 40). Some protection is provided in the Kinlichee Creek watershed, where logging prescriptions are in place to protect the riparian areas for the Zuni bluehead sucker and their habitat through implementation of this management plan. However, this plan would protect against future forest management and not provide protection from other threats to the species.

Summary of Factor D

Many Federal, State, and Tribal statutes potentially afford protection to Zuni bluehead sucker. A few of these are the Federal Land Policy and Management Act (43 U.S.C. 1701–1782), the National Forest Management Act (16 U.S.C. 1600 *et seq.*), and the Clean Water Act (33 U.S.C. 1251 *et seq.*). However, in practice, the provisions of these statutes that require consideration of rare species have not been able to address the threats to the Zuni bluehead sucker.

In summary, the States' endangered species and water withdrawal regulations, as well as the Federal Land Policy and Management Act and the National Forest Management Act, are not adequate to protect the Zuni bluehead sucker or its habitat. State regulations prohibiting take of the

species have been in place for decades; however, these regulations do not address the threats to habitat, particularly water withdrawals, impoundments, and the distribution and abundance of nonnative fishes. Because most of the threats to the Zuni bluehead sucker are from effects to its habitat and the introduction of nonnative, invasive species, in order to protect individuals and ensure the species' long-term conservation and survival, its habitat must be protected. Therefore, we conclude these existing regulations are inadequate to reduce the impacts of identified threats to the species.

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

Other natural or manmade factors affecting the continued existence of the Zuni bluehead sucker include habitat fragmentation, which is intensified by the small sizes of the remaining populations.

Habitat Fragmentation

Zuni bluehead sucker populations appear to have always been relatively isolated from one another, as evidenced by the genetic lineages that have been observed (Service 2012b, pers. comm.). The further fragmentation of habitat and resulting increased isolation of Zuni bluehead sucker populations affects the species rangewide, by increasing the risk of population loss and subsequent loss of genetic lineages. Dewatering and drought conditions have resulted in fragmentation of Zuni bluehead sucker populations, and continued water demands are expected to further reduce habitat available to the Zuni bluehead sucker and will likely further fragment and isolate populations. Fragmentation of Zuni bluehead sucker habitat increases the species' vulnerability from threats of further habitat loss and competition from nonnative fish because immigration and recolonization from adjacent populations is less likely. In-depth analyses of southwestern fish occurrence patterns led Fagan *et al.* (2002, p. 3254) to conclude that the number of occurrences or populations of a species is far less significant in determining extinction risk than is fragmentation of the species. Another source of habitat fragmentation is the construction of dams. Dams are known to change the hydraulics of the streams in the system, converting many formerly perennial streams into semiperennial or ephemeral streams that prevent movement of fish between populations and dramatically alter the flow regime of streams through the impoundment of water (Ligon *et al.* 1995, pp. 184–189).

Small, isolated populations are subject to genetic threats, such as inbreeding depression (reduced health due to elevated levels of inbreeding) and to genetic drift (a reduction in gene flow within the species that can increase the probability of unhealthy traits; Meffe and Carroll 1994, pp. 156–157, 166–167). The percent of facial deformities have ranged from 3.7 to 12.1 percent of the population at Tampico Spring since 2007; these deformities may be attributed to the genetic effects of small populations (NMDGF 2013, pp. 22–23). It is not known if these deformities will impact the survivability of these Zuni bluehead sucker. It remains unclear what factors (genetic, environmental stress, or their combination) caused deformities in this population. Previous studies have revealed that some deformities in fish result from environmental stressors, such as those related to temperature (Sato *et al.* 1983, entire; Abdel *et al.* 2004, entire), mineral nutrition (Baeverfjord *et al.* 1998, entire), or heavy metals (Messaoudi *et al.* 2009, entire).

Due to the small reaches of remaining habitat where Zuni bluehead suckers occur in relatively low numbers, single populations of Zuni bluehead sucker are at high risk of extirpation due to stochastic events from other known threats, such as wildfire or episodic drought (see Factor A discussion). Zuni bluehead sucker have experienced and withstood a number of droughts over time, but given the anticipated increased frequency and duration of drought, combined with the reduced population size and occupied habitat, the species is at a higher risk of extirpation and the species has a reduced resiliency to stochastic events.

Summary of Factor E

The Zuni bluehead sucker populations are highly fragmented within small, isolated springs and stream segments, causing them to be vulnerable to stochastic events, such as wildfire and episodic drought. All known Zuni bluehead sucker populations are small and isolated, increasing their vulnerability. Due to the reduction in their range, and small population size, the remaining populations of Zuni bluehead sucker experience reduced viability; therefore, we conclude that habitat fragmentation is a threat to Zuni bluehead sucker.

Cumulative Effects: Factors A Through E

Many of the threats discussed above act in concert, and the resulting effects to Zuni bluehead sucker are amplified. For example, the reduction of water quantity restricts the geographic size of the population, which causes the species to be more vulnerable to other threats, such as beaver dams modifying habitat, an increase in nonnative predators, or ash flows from wildfire that may further reduce or eliminate the population. The ability of a population to be resilient to threats depends on the robustness of the population. For Zuni bluehead sucker, the remaining populations are likely not robust. They are reduced in size and their habitat has been reduced to a fraction of their historical range. Given these circumstances, the combined effect of current threats to the populations puts the species at risk rangewide. The combined effects of drought and nonnative predatory fish may reduce habitat, fragment the remaining habitat, and reduce reproductive potential, resulting in fewer fish. The remaining populations become less resilient and are not capable of recovering from the threats. Reproductive efforts from the Zuni bluehead sucker populations will be affected by the threats to their habitat, resulting in populations with reduced viabilities.

Determination

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.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Zuni bluehead sucker. Habitat loss from water withdrawals, sedimentation, and impoundments is occurring rangewide, has resulted in extirpation of the species from all but headwater habitats, and is not likely to be reduced in the future (Factor A). The species' range has been reduced over 95 percent in New Mexico, and current distribution is limited to three populations in 3.7 km (2.3 mi) of streams (Service 2014a, pers. comm.). Drought frequency and water

withdrawals are likely to increase, further restricting habitat and fragmenting or eliminating populations. Predation from nonnative fish is occurring rangewide and has been shown to reduce recruitment and population size at one location; this situation is likely impacting other populations, as well (Factor C). State wildlife laws and Federal regulations such as the National Forest Management Act are not adequate to address the threats to the species (Factor D). Additionally, the Zuni bluehead sucker is not able to naturally recolonize unoccupied areas (Factor E). There is virtually no redundancy of populations within each occupied watershed, further increasing the risk of loss of representation of existing genetic lineages and, ultimately, extinction. These threats have already resulted in the extirpation of Zuni bluehead sucker throughout an estimated 95 percent of its New Mexico range and are only likely to increase in severity. Although less information is available on threats occurring on the Navajo Indian Reservation, the information we do have is similar in kind and intensity to that for New Mexico. These threats are ongoing, are rangewide, are expected to increase in the future, and are significant because they further restrict limited available habitat and decrease the resiliency of the Zuni bluehead sucker within those habitats.

The Act defines an endangered species as any species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as any species ''that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.'' We find that the Zuni bluehead sucker is presently in danger of extinction throughout its entire range based on the severity and immediacy of threats impacting the species. The overall range has been significantly reduced, and the remaining habitat and populations are threatened by a variety of factors acting in combination to reduce the overall viability of the species. The risk of extinction is high because the remaining populations are small, isolated, and have limited potential for recolonization. Therefore, on the basis of the best available scientific and commercial information, we have determined that the Zuni bluehead sucker meets the definition of an endangered species in accordance with sections 3(6) and 4(a)(1) of the Act. We find that a threatened species status is not appropriate for the Zuni bluehead sucker because of the contracted range (loss of 95 percent of its New Mexico range and much reduced in Arizona), because the threats are occurring rangewide and are not localized, and because the threats are ongoing and expected to continue into the future.

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

Listing the Zuni bluehead sucker as a threatened species is not the appropriate determination because the ongoing threats described above are severe and pose an immediate risk of extinction. These threats include habitat destruction, modification and degradation resulting from water withdrawal (stream drying), sedimentation, impoundments, and livestock grazing. Many of the activities are ongoing throughout the range of the Zuni bluehead sucker, and climate change is anticipated to cause more periods of drought, exacerbating the effects of water withdrawal, sedimentation, and livestock grazing. Additionally, predation by nonnative green sunfish and crayfish, which are present within or near occupied sites of Zuni bluehead, has the ability to limit recruitment and reduce population size. The small population size and restricted range of the species make the Zuni bluehead sucker population vulnerable to stochastic events, such as wildfire and drought. Therefore, all of these factors combined lead us to conclude that the threat of extinction is high and immediate, thus warranting a determination of an endangered species rather than a threatened species for the Zuni bluehead sucker.

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 requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

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

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

or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

Following publication of this final listing rule, 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 Zuni bluehead sucker. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

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

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

Federal agency actions within the species' habitat that may require conference or consultation or both as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the U.S. Fish and Wildlife Service and U.S. Forest Service, issuance of section 404 Clean Water Act permits by the Army Corps of Engineers; and construction and maintenance of roads or highways by the Federal Highway Administration.

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

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

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

(2) Introduction of nonnative species that compete with or prey upon the Zuni bluehead sucker, such as the introduction of nonnative green sunfish and/or nonnative trout to the States of Arizona and New Mexico;

(3) Release of biological control agents that attack any life stage of this species;

(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 Zuni bluehead sucker is known to occur; and

(5) Discharge of chemicals or fill material into any waters in which the Zuni bluehead sucker is known to occur.

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

Required Determinations

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 began government-to-government consultation with these tribes through the public comment period and during the development of the final listing determination. The Navajo Nation, Ramah Navajo, and Zuni Pueblo are the main Tribes affected by this final rule.

We sent notification letters in July of 2012 to each Tribe describing the exclusion process under section 4(b)(2) of the Act, and we have engaged in conversation with the Tribes about the proposed listing and critical habitat rules to the extent possible without disclosing predecisional information. We have maintained contact with Navajo Nation, Ramah Navajo Chapter, and Zuni Pueblo through letters, phone calls, and emails, and we have provided each tribe with notice of publication dates of various documents.

Navajo Nation—We coordinated several survey efforts with Navajo Nation in 2012 and 2013. A coordination meeting was held in March 2013 to gain a better understanding of the Nation's position and concerns regarding the proposed listing and designation of critical habitat. We received comments from the Nation during the first open comment period. Their comment letter provided information regarding applicable laws and fish, wildlife, and environmental plans that would offer some protection to the Zuni bluehead sucker. In addition, their letter stated their concerns regarding the taxonomic status of the Zuni bluehead sucker on the Navajo Nation. The Navajo Nation is working with us to develop a Navajo Nation Fisheries Management Plan.

Ramah Navajo Chapter—We did not receive comments from the Ramah Navajo Chapter. However, we did make a site visit in January 2014 to evaluate proposed designation of critical habitat.

Zuni Pueblo—We did not receive comments from Zuni Pueblo. However, we have encouraged Zuni Pueblo to develop a Fisheries Management Plan for the Zuni bluehead sucker.

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 New Mexico Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

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

List of Subjects in 50 CFR Part 17

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

Regulation Promulgation

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

PART 17—[AMENDED]

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

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

■ 2. Amend § 17.11(h) by adding an entry for ''Sucker, Zuni bluehead'' to the List of Endangered and Threatened Wildlife in alphabetical order under Fishes to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*		*
Fishes							
*	*	*	*	*	*		*
Sucker, Zuni bluehead	*Catostomus discobolus yarrowi.*	U.S.A. (AZ, NM)	Entire	E	839	NA	NA
*	*	*	*	*	*		*

* * * * *

Dated: July 2, 2014.

Stephen D. Guertin,

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

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