Chihuahua chub
(Gila nigrescens)
5-Year Status Review:
Summary and Evaluation

Photo Credit: Serena Kucera, USFWS New Mexico Fish and Wildlife Conservation Office

U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
Albuquerque, NM
August 23, 2023

5-YEAR REVIEW
Chihuahua chub *(Gila nigrescens)*

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional or Headquarters Office:

Gary Pandolfi, Recovery Biologist, Southwest Regional Office
Angela D. Anders, Ph.D., Recovery Program Coordinator, Southwest Regional Office

Lead Field Office:

Chad Baumler, Species Lead, New Mexico Ecological Services Field Office

Cooperating Field Office(s):

Serena Kucera, New Mexico Fish and Wildlife Conservation Office
Wade Wilson, Southwest Native Aquatic Resources and Recovery Center

Cooperating State Wildlife Office(s):

The U.S. Fish and Wildlife Service (USFWS) greatly appreciates species expertise and biological knowledge provided on previous drafts of the background, biology, life history, taxonomy, and recent survey sections by New Mexico Department of Game and Fish biologists Matthew Zeigler – Colorado River Basin Native Fish Supervisor, and Jasmine Johnson – Gila and Mimbres Basin Native Fish Biologist.

1.2 Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service is required by section 4(c)(2) of the Endangered Species ESA (ESA) to conduct a status review of each listed species once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing as endangered or threatened is based on the species' status considering the five threat factors described in section 4(a)(1) of the ESA. These same five factors are considered in any subsequent reclassification or delisting decisions. In the 5-year review, we consider the best available scientific and commercial data on the species and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process including public review and comment.

1.3 Methodology used to complete the review:

This review was conducted through public review notification and a comprehensive review of all documents regarding Chihuahua chub (*Gila nigrescens*) that were available to the USFWS' New Mexico Ecological Services Field Office (NMESFO). The Federal Register notice (86 FR 23976) announcing this review was published on May 5, 2021, and solicited new information about species' biology, habitat conditions, conservation measures implemented, threats, and trends from other government agencies, nongovernmental organizations, academia, and the public. Information compiled from monitoring data collected by the New Mexico Department of Game and Fish (NMDGF) and peer-reviewed literature provided the basis for the review. This review was drafted by Chad Baumler, lead biologist for the Chihuahua chub in the NMESFO.

1.4 Background:

1.4.1 Federal Register Notice citation announcing initiation of this review:

86 FR 23976

1.4.2 Listing history:

Original Listing
FR notice: 48 FR 46053
Date listed: October 11, 1983
Entity listed: *Gila nigrescens*
Classification: Threatened

1.4.3 Associated Rulemakings:

A special ESA Section 4(d) rule was included in the initial listing package. This rule gave the NMDGF scientific permitting authority for the species (48 FR 46057).

1.4.4 Review History:

This is the second 5-year review for the species. The first was conducted in 2010 (USFWS 2010).

1.4.5 Species' Recovery Priority Number at start of 5-year review:

The species' recovery priority number is currently a 5, indicating a high degree of threat and a low probability of recovery.

1.4.6 Recovery Plan or Outline

Name of plan or outline: Chihuahua Chub Recovery Plan
Date issued: April 14, 1986
Dates of previous plans/amendment or outline, if applicable: N/A

2.0 REVIEW ANALYSIS

Section 4 of the ESA (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The ESA defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The ESA requires that we determine whether a species meets the definition of "endangered species" or "threatened species" due to any of the five factors described below.

Section 4(a) of the ESA describes five factors that may lead to endangered or threatened status for a species. These include: 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.

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

2.1 Distinct Population Segment (DPS) policy (1996):

The DPS policy does not apply to this species.

2.2 Updated Information and Current Species Status

2.2.1 Biology and Habitat

2.2.1.1 New information on the species' biology and life history:

Information on the biology and life history of the Chihuahua chub has not changed since the previous five-year status review (USFWS, 2010). Below we provide a brief overview of the species life-history.

The Chihuahua chub has a fusiform body that resembles some trout. It has a terminal mouth that extends backward to about the margin of the eye (Sublette et al. 1990). In individuals over 100 millimeters (mm) (3.9 inches (in)), the back and sides are brassy green to slate gray, sometimes with two indistinct lateral stripes, and the abdomen is whitish (Sublette et al. 1990). Males and females in

reproductive condition are orange-red ventrally at the bases of the paired fins and around the mouth (Propst 1999). Spawning males are typically more intensely colored than females and have numerous small tubercles on the head. The tail fin is rounded at the tips. Males tend to be smaller than females (Propst and Stefferud 1994). Young individuals are silvery to gray dorsally and whitish ventrally.

The reproductive biology of Chihuahua chub has not been studied; however, observations of reproductive condition have been made during surveys. In lower elevations in Chihuahua, Mexico, reproductively ripe individuals were found in March (Propst and Stefferud 1994) while Sublette et al. (1990) indicate that spawning occurs in late April or May in New Mexico. Based on reproductive condition and size of individuals in various months, Propst (1999) suggests that spawning may extend from early spring through fall. Observations by NMDGF during sampling events suggest spawning occurs into late summer in New Mexico. Eggs are scattered over sand/silt substrates (Sublette et al. 1990). Sublette et al. (1990) suggest that Chihuahua chub is an opportunistic carnivore, feeding on invertebrates and possibly fish. However, no specific studies on food habits have been conducted.

2.2.1.2 Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, birth rate, seed set, germination rate, age at mortality, mortality rate, etc.), or demographic trends:

Information from Mexico is limited to the trend seen between historical collections and the three surveys that were done in 1964, 1979, and 1990 (Miller and Chernoff 1979, Propst and Stefferud 1994). Primarily because of water extraction, diversion (stream drying), and pollution, there was a downward trend in site occupancy over time in the streams of Chihuahua (Miller and Chernoff 1979, Propst and Stefferud 1994). Miller and Chernoff (1979) found the species at only 8 of 16 sites where it had formerly been common, and it was abundant at only 3 of the 8 sites. Propst and Stefferud (1994) found the range and abundance of Chihuahua chub in Chihuahua, Mexico had decreased dramatically, and that the species was only comparatively common in remote areas relatively free of habitat modification. No additional surveys have been conducted in Mexico since the 1990s. Therefore, for the purposes of this status review we presume the status of the species in Mexico has continued to decline given limited conservation efforts, continued habitat loss, and continued effects of climate change.

The Mimbres River, New Mexico was stocked in 2010, 2013, 2015, 2016, and 2018-2021 (Table 1 and Figure 8). Typically, Chihuahua chub 76-100 mm (3-4 in) are stocked on NMDGF and The Nature Conservancy (TNC) properties, but stockings upstream at Monument and Cooney Canyons have also taken place since the last 5-year review. Annual surveys of the Mimbres River are

conducted by NMDGF in the fall and have been ongoing since the 1990s (Johnson 2022). Monitoring indicates that expansion of the population took place after the near extirpation of the Mimbres River population because of the Silver Fire in 2013. Prior to the Silver Fire, the population was considered stable (USFWS 2010). The full dynamics of fish movement in the system are not well understood, but movement of fish may explain the fluctuation in catch-per-unit-effort during sampling (Figure 1). The habitat on the mainstem of the Mimbres River has supported all age classes (Figure 2).

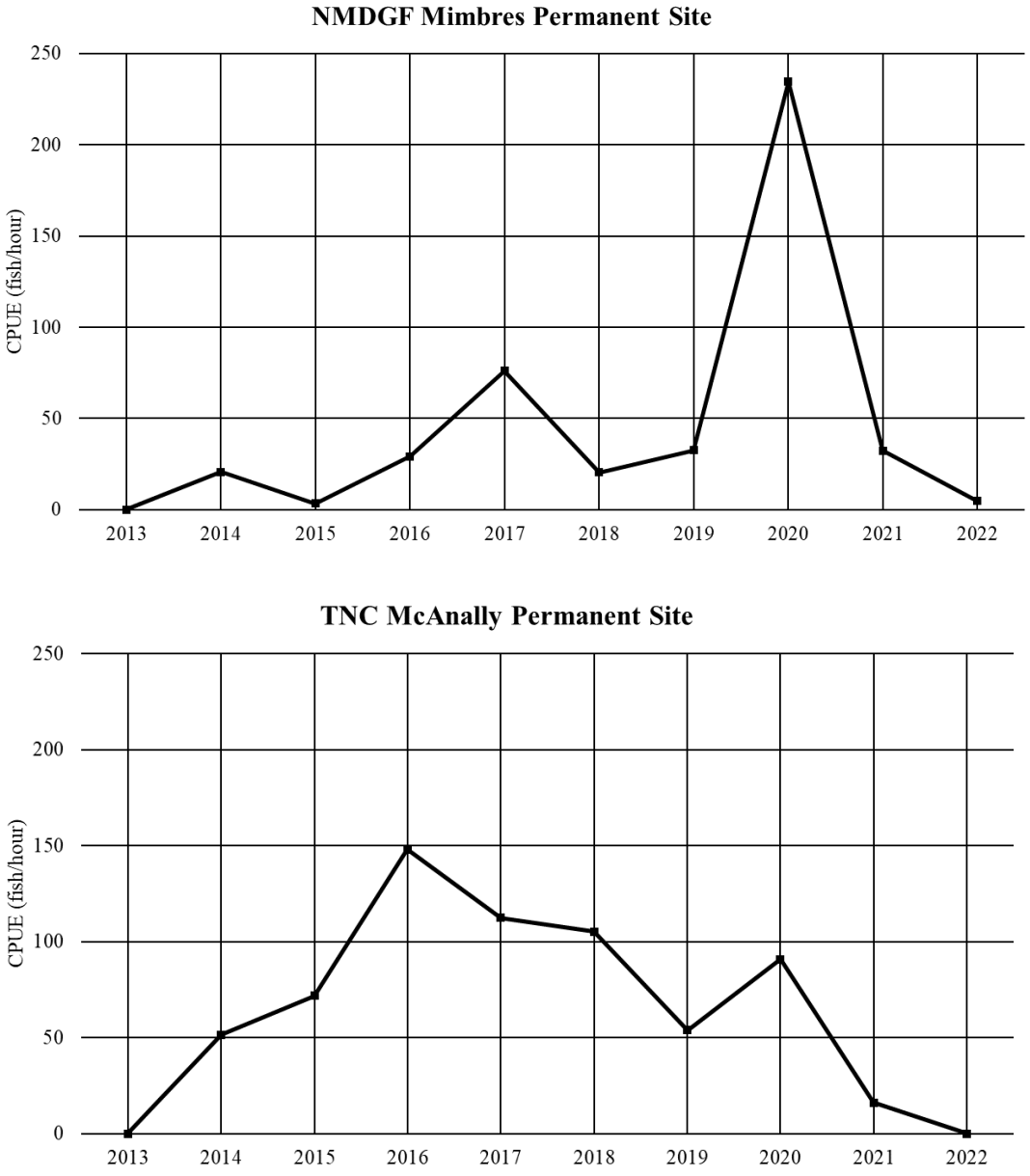

Figure 1. Catch-per-unit-effort (CPUE, fish/hour) of Chihuahua chub during annual Mimbres River fall monitoring at the NMDGF and TNC McAnally

permanent sites, 2013 – 2022. No Chihuahua chub were collected during sampling at these locations in April 2023; however, these data are not represented on this graphic.

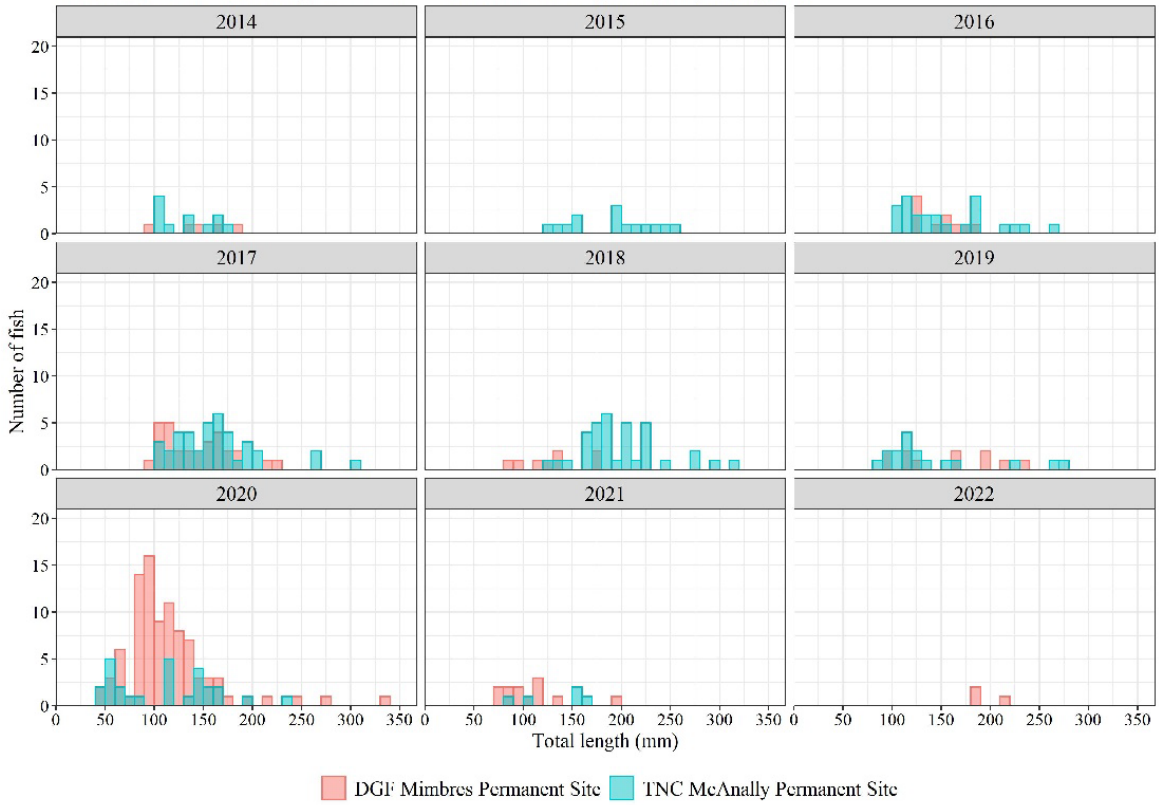

Figure 2. Length frequency histograms of Chihuahua chub collected during fall sampling events in the Mimbres River (2014-2022). Surveys were conducted by NMDGF and USFWS biologists. Monitoring and collection in 2022 took place after the Black Fire and subsequent flooding events. No Chihuahua chub were collected during sampling at these locations in April 2023; however, these data are not represented on this graphic.

The Black Fire in the summer of 2022 had a significant effect on watershed health in the Mimbres Basin (Figures 3 and 4). The Black Fire began on May 13, 2022, and burned approximately 325,136 acres, before being extinguished by fire suppression efforts and seasonal monsoons (NWCG 2023). A salvage survey conducted by NMDGF took place in June 2022 to remove Chihuahua chub (n=49) from the Mimbres River and relocate them to the refugia pond on NMDGF River Ranch property (Figure 5). The full effects from the fire on the population are not fully understood, but subsequent monitoring indicated that some individuals did survive. Post-fire sampling in the Mimbres River collected n=3 during annual fall 2022 monitoring, n=22 collected in Moreno Springs in September 2022, n= 1 in Cooney Canyon and n=2 in Moreno Springs in December 2022, and n=1 fish in Moreno Springs in May 2023 (Matt Ziegler, pers comms.). Moreno Springs was likely the least impacted portion of the

Mimbres Basin by the 2022 Black Fire; however, sampling has been complicated since the fall of 2022 due to a beaver dam construction.

Annual monitoring competed by NMDGF and USFWS biologists in April 2023 failed to locate any live Chihuahua chub (n=0) in the Mimbres River. Sampling included the permanent monitoring sites on NMDGF and TNC properties and four randomly selected sites. However, two randomly selected sites had to be relocated due to inaccessible road damage. Overnight minnow traps located in the River Ranch Refugia pond captured n=26 Chihuahua chub. All fish collected from the refugia pond appeared to be in good health and condition (USFWS 2023).

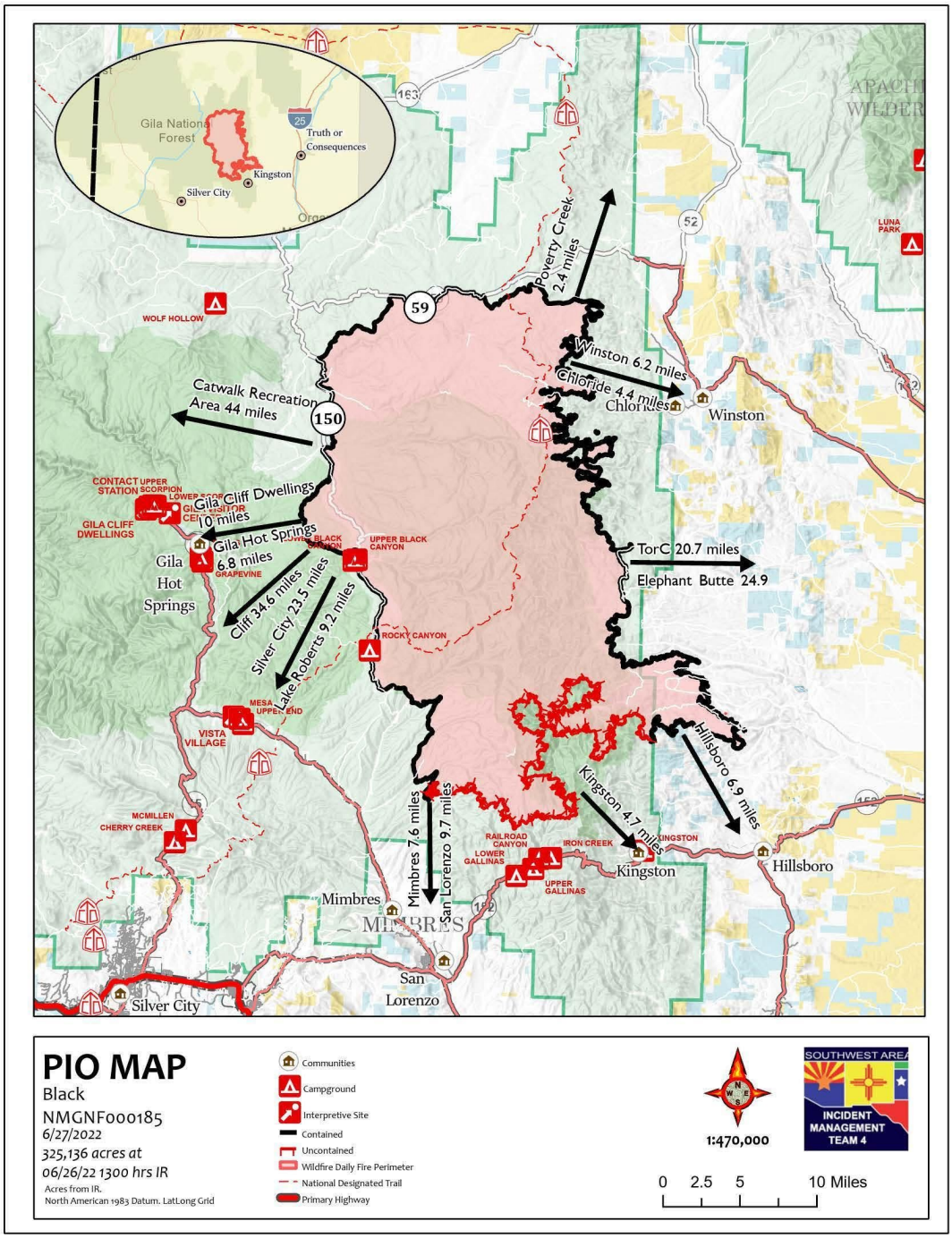

Figure 3. Burned area of the Black Fire, NM as of June 27, 2022. Note that the Mimbres River and tributaries are located north of the town of Mimbres, NM and south of Rock Canyon campground, as displayed above.

Figure 4. Ash and debris flow in the Mimbres River following the 2022 Black Fire and monsoon rains. Photograph by Serena Kucera (USFWS) on June 27, 2022, looking downstream (approx. 32.843868, -107.961834) at the NMDGF owned property near the town of Mimbres, NM.

Figure 5. NMDGF River Ranch Refugia Pond. An off channel refugia pond created in April 2021 to hold Chihuahua chub, located at approximately (32.588420, -107.918330). Photo Credit: Matt Zeigler, NMDGF.

Propagated Chihuahua chub have been stocked into McKnight Canyon, a tributary to the Mimbres River in 1992, 2018, 2019 and 2022, to augment and expand the wild population (Table 1 and Figure 8). Chihuahua chub have been documented persisting in McKnight Canyon several years after stocking. A 2021 electroshocking survey conducted by NMDGF failed to detect any Chihuahua chub, but an eDNA survey conducted that same year by the U.S. Forest Service (USFS) detected the presence of the species (Matt Zeigler pers comms). USFWS biologists sampled McKnight Canyon in April 2022 and discovered two pool habitats above the fish barrier that may support Chihuahua chub. During these surveys, only n=4 live Chihuahua chub were collected, and it is suspected these were stocked fish. Further, there is no evidence of reproduction in McKnight Canyon, and the habitat is considered marginal because of the lack of habitat complexity (USFWS 2022). Surveys have not been conducted in McKnight Canyon following the 2022 Black Fire, and the effects on this stream are not fully understood at this time. Currently, there does not appear to be an established population of Chihuahua chub present in McKnight Canyon.

Fish were stocked in Moreno Springs (Figure 6), an off-channel spring system that is connected to the Mimbres River, in 2016, and this population appeared to be stable with natural recruitment. The River Ranch Refugia Pond, a recently constructed off-channel pond to support a refugia population of Chihuahua chub (NMDGF 2022; Figure 5), was stocked with n=200 fish in 2021. In 2022, n=49 fish were moved to the pond from the Mimbres River during a salvage operation after the Black Fire (Johnson 2022). Chihuahua chub from the initial stocking in 2021 and the salvage in 2022 have continued to persist in the River Ranch Refugia Pond. After the Black Fire, n=26 fish were captured in the River Ranch Refugia Pond during limited sampling in October 2022 (Johnson 2022). n=26 Chihuahua chub were collected using overnight minnow traps in the refugia pond in April 2023. All fish appeared to be in good condition and health (USFWS 2023). Fall monitoring efforts in 2023 will survey the River Ranch Refugia Pond population and further elucidate the species' status there. Currently, there is no evidence of reproduction in the River Ranch Refugia Pond.

Figure 6. Biologists are seen backpack electrofishing at Moreno Springs in 2013, an off-channel spring system that drains into the Mimbres River. Located at approximately (32.889337, -107.990267). Photo Credit: Matt Zeigler, NMDGF.

2.2.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Osborne et al. (2012) conducted a genetic analysis comparing the populations in New Mexico to each other and to the populations located in Mexico. The study compared genetic markers from nine microsatellites and two sequenced mitochondrial DNA fragments to understand if genetic drift has occurred due to the fragmented nature of Chihuahua chub populations. The samples were obtained from four locations in New Mexico: Southwestern Native Aquatic Resources Recovery Center (SNARRC; conservation hatchery population), the permanent sampling sites on the lower portion of the Mimbres River, the upper Mimbres River near Cooney Place, and Moreno Springs. Samples were also taken from historically collected specimens collected at five locations in Mexico: Rio Santa Maria, Rio Santa Clara, Rio Casas Grandes, Arroyo San Miguel, and Rio Papigochic. All Mexico locations except Rio Papigochic are located in the Guzman Basin. Additionally, "a few specimens" were collected from Mexico during 2009 and 2010 (Mayden 2023 and Osborne et al. 2012). However, despite searching multiple ichthyology collections (University of New Mexico, Alabama, and Florida) and contacting several former researchers, we are unable to determine the location and number of fishes collected during these surveys.

The study concluded that there was minimal divergence between Mexico populations, including Rio Papigochic (Yaqui Basin) located outside of the Guzman Basin (rest of Mexico samples), but that there was significant genetic divergence when compared with the New Mexico populations, which showed unique alleles and attributes (Osborne et al. 2012). Mitochondrial diversity among New Mexico and Mexico individuals differed, with Mexico having unique and more haplotypes, which was expected considering the small population size and lack of connectivity among populations in the United States. Osborne et al. (2012) found that the population discovered at Cooney Place was most likely an aboriginal population and not founded by stockings in McKnight Canyon or at the permanent sites in the lower Mimbres River. The study also suggested that the captive population at SNARRC (lowest microsatellite allelic diversity) should be augmented with individuals from more diverse populations such as Moreno Springs (highest allelic diversity). However, post-2012 SNARRC augmentation occurred only twice, with small numbers of individuals (n=4 from Moreno Springs and n=5 from the TNC McAnally Tract in 2016; see Section 2.2.1.8 below).

The Osborne et al. (2012) study concluded that the genetic divergence shown in the New Mexico population should be used to designate the population as an evolutionarily significant unit (ESU). Moritz (1994) put forth the criteria that ESU's should be reciprocally monophyletic for mitochondrial haplotypes and should show significant divergence of nuclear allele frequencies.

2.2.1.4 Taxonomic classification or changes in nomenclature:

There are no changes in taxonomic classification or nomenclature.

2.2.1.5 Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors, pollinator availability, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species within its historic range, etc.):

The historical range of Chihuahua chub is difficult to determine because of the lack of early collections. Most likely all but the uppermost reaches of permanently watered portions of the Mimbres River, New Mexico, and streams in the Guzman and Laguna Bustillos basins in Mexico were occupied (Propst and Stefferud 1994). All streams within the historical range flow into a closed (endorheic) basin; none have a connection with the ocean.

There are approximately 345 km (215 mi) of potential habitat in Chihuahua, Mexico. A fraction of potentially occupied habitat in Chihuahua has been surveyed, and the populations outside of the United States to our knowledge have not been surveyed since the last status review.

Tributaries of the Mimbres River in New Mexico were not believed to have supported the species in the past (Propst and Stefferud 1994). However, surveys of the Mimbres River population had shown dispersal upstream in the system to Monument and Cooney Canyons since the last status review (Osborne 2019). Surveys conducted by NMDGF and an eDNA analysis conducted by the USFS (Young et al. 2022) suggested a 43 km (27 mi) increase in the range of the species, for a total of 58 km (36 mi) of potentially occupied river (Figure 7). That dispersal was augmented with stockings from the hatchery population (Table 1 and Figure 8), but Chihuahua chubs continued to disperse upstream from the limited stocking locations.

There have been attempts to establish a population in McKnight Canyon (the East Fork Mimbres River) in the Mimbres Basin. As of 2022, reproduction had not been documented in McKnight Canyon, but Chihuahua chub had been documented persisting in low abundances several years after stocking (USFWS 2022). The 2022 survey discovered n=4 Chihuahua chub in a pool habitat in McKnight Canyon; the last stocking had taken place in 2020 (Table 1 and Figure 8).

The River Ranch Refugia Pond, a recently constructed off-channel pond to support a refugia population of Chihuahua chub (NMDGF 2022; Figure 5), was stocked with n=200 fish in 2021. Due to the significant effects of the 2022 Black Fire on the Mimbres Basin (Section 2.2.1.2 and Figures 3 and 4), in 2022 NMDGF salvaged a total of n=49 Chihuahua chub from the Mimbres River and placed them in the River Ranch Refugia Pond (Figure 6). Chihuahua Chub from

the initial stocking in 2021 and the salvage in 2022 have continued to persist in the River Ranch Refugia Pond. Small individuals have been collected from the pond, but it is not known if these represent wild spawned fish or PIT tag losses. Therefore, recruitment has not been documented for this population, but surveys have determined that fish are persisting in the refugia pond. In April 2023, n=26 Chihuahua chub were collected from the refugia pond utilizing overnight minnow traps (Service 2023).

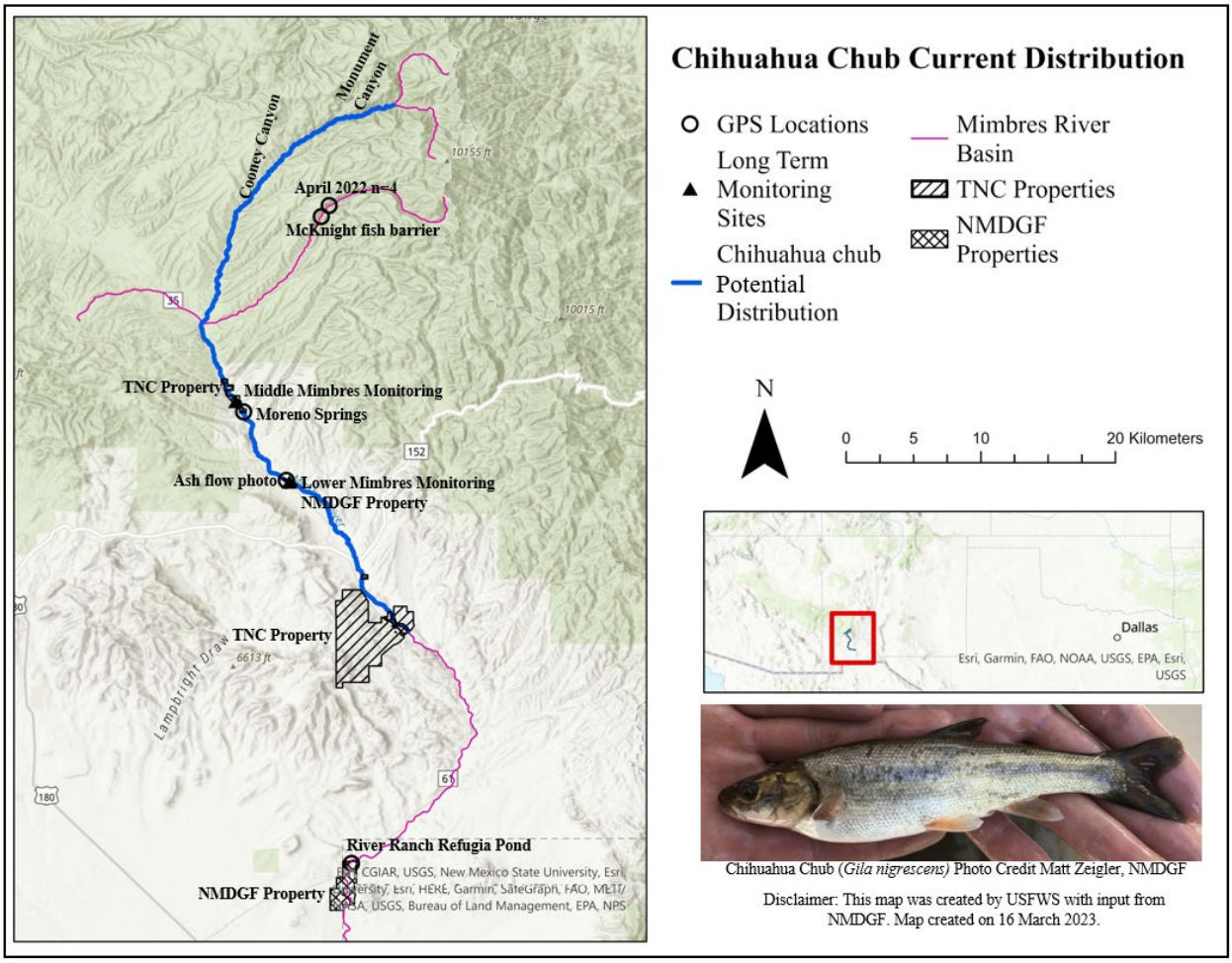

Figure 7. Potential distribution of Chihuahua chub in the Mimbres River Basin, New Mexico, prior to the 2022 Black Fire.

At this time, in the U.S. the Chihuahua chub is known to occur in the River Ranch Refugia Pond (n=200 individuals stocked in November 2021 and n=49 stocked during salvage efforts in June 2022) and SNARRC (n=434 fish as of April 2022). Surveys completed in December 2022 resulted in n=1 fish collected while April 2023 surveys failed to detect Chihuahua chub across NMDGF and TNC long-term permanent monitoring sites as well as four additional sites surveyed. Chihuahua chub may persist in the mainstem Mimbres River, post-2022 wildfires, but are below detection thresholds (USFWS 2023).

Wildfire impacts at Moreno Springs are not believed to be as significant as those seen on the Mimbres River mainstem, and it is believed an unknown number of Chihuahua chub continue to occur. The current status of the population in Mexico is unknown, but the species is likely to occur there in only small numbers.

2.2.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Adult Chihuahua chub are considered habitat specialists. They are found in their natural habitats primarily in lateral scour pools, beneath undercut banks, or under other solid objects (e.g., logs, boulders) adjacent to moderate to fast flowing water in small to medium sized streams (Miller and Chernoff 1979, Propst and Stefferud 1994). Corner and backwater pools containing large woody debris are also used as habitat. Almost all natural habitats occupied by Chihuahua chub have extensive cover composed of organic debris or root wads of large trees. Pools are typically 1-2 m deep with a water velocity of less than 15 cm/second, and substrates are small-grained (sand to pea-size) (Propst and Stefferud 1994, Propst 1999). Juveniles are found in shallower water with or without cover (Miller and Chernoff 1979).

Although we initially proposed critical habitat for the species (45 FR 82474), it was not designated in the final listing rule. The final listing rule (48 FR 46053) states that critical habitat was not designated because the Governor of New Mexico, the NMDGF, and the New Mexico Department of Agriculture opposed designation. In addition, local landowners had expressed concern over how critical habitat designation might affect flood control and irrigation practices (48 FR 46053).

2.2.1.7 Other:

None

2.2.1.8 Conservation Measures:

There have been continued stocking efforts and maintenance of the broodstock located at SNARRC (Table 1 and Figure 8). The current captive population size at SNARRC is n=434 fish as of April 2022. SNARRC is also currently working toward cryopreserving Chihuahua chub genetics at the USFWS Warm Springs Fish Technology Center (Warm Springs, Georgia). If successful, the preserved genetics may provide additional recovery options in the future to safeguard against stochastic events.

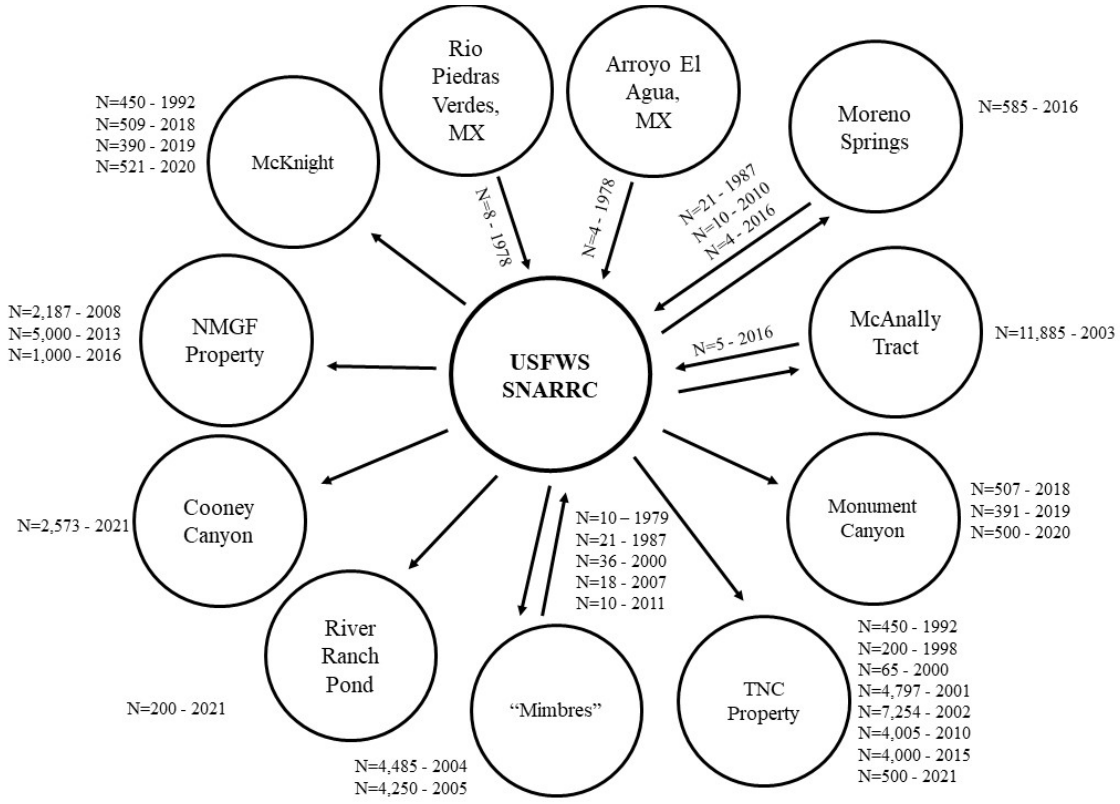

Figure 8. Fish collections and stockings reports provided by SNARRC from 1979 to 2021. Numbers of fish on the inner circle represent fish taken into hatchery broodstock, and numbers of fish on the outer circle represent fishes released into the wild. Direction of fish movement indicated by arrow direction. All information included in this figure, and hatchery broodstock reports, are represented below in Table 1.

Table 1. Fish collections, stockings, and broodstock maintenance reports provided by SNARCC from 1979 to 2022. PIT = Passive Integrated Transponder. Information provided by Wade Wilson, USFWS.

Date	Action	Number of Fish	Size	Comments
3/27/1979	Fish In	10	Various	Fish received from Mimbres River, Grant County, NM.
5/15/1987	Fish In	21	Various	Fish collected on the Moreno Property, adjacent to Mimbres River, near Mimbres, Grant County, NM.
10/28/1992	Fish Out	450	3"-7", 65lbs	Fish Stocked into Gila National Forest-McKnight Canyon.
12/31/1998	Fish Out	200	4", 14lbs	Stocked at TNC Property, Mimbres River, NM.

Date	Action	Number of Fish	Size	Comments
2/10/2000	Fish Out	65	2"	Fish were stocked at TNC Property, Mimbres River, NM.
2/11/2000	Fish In	36	Various	Fish collected from Mimbres River, Grant County, NM and USFWS Hatchery.
2/15/2001	Fish Out	4,797	3.5", 123lbs	Fish were stocked at TNC, Mimbres River, NM.
11/1/2002	Fish Out	7,524	3.5", 120lbs	Fish were stocked at TNC Property, Mimbres River, NM.
6/4/2003	Fish Out	7,228	3"-4", 139lbs	Fish were stocked at the McAnally Tract and NMDGF Property, Mimbres River, NM.
11/24/2003	Fish Out	4,657	3", 80.3lbs	Fish were wire tagged and stocked at the McAnally Tract and NMDGF Property, Mimbres River, NM.
10/14/2004	Fish Out	4,485	3", 295.1lbs	Fish were wire tagged and stocked into the Mimbres River, NM by James Lay.
11/22/2005	Fish Out	4,250	4", 115lbs	Fish were stocked into the Mimbres River, NM.
7/1/2007	Fish In	18	Various	Fish collected from the Mimbres River, NM. Fish were PIT tagged and integrated into the broodstock.
10/21/2008	Fish Out	2,187	3.5", 35.5lbs	Fish were stocked at the NMDGF Property, Mimbres River, NM.
6/24/2009	Inventory	732	Various	Broodstock at SNARRC.
11/4/2010	Fish Out	4,005	3.5", 44 lbs	Fish were stocked into the Mimbres River at TNC Property.
11/4/2010	Fish In	10	Various	Fish Collected from Moreno Springs, PIT tagged and integrated into broodstock.
5/25/2011	Fish In	10	Various	Fish Collected from Rio Mimbres, PIT tagged and integrated into broodstock.
12/13/2011	Inventory	669	Various	Broodstock at SNARRC.

Date	Action	Number of Fish	Size	Comments
4/26/2013	Inventory	490	Various	Broodstock at SNARRC.
12/13/2013	Fish Out	5,000	100mm, 94 lbs	Fish were stocked into the Mimbres River at the NMDGF property and TNC McAnally tract.
5/4/2015	Inventory	450	Various	Broodstock at SNARRC.
11/30/2015	Fish Out	4,000	92mm, 74 lbs	Fish were stocked into the Mimbres River at TNC McAnally Tract (1,927 fish were PIT tagged, 2,073 were not tagged).
4/20/2016	Fish in	5	50-100mm	Fish Collected from Rio Mimbres at the McAnally tract, PIT tagged and integrated into broodstock. Collection location UTM: Start (downstream)= 13 S 0219969 E, 3643516 N; End (upstream)= 13 S 0219673 E, 3644094 N.
4/20/2016	Fish in	4	50-100mm	Fish Collected from Moreno Spring, PIT tagged and integrated into broodstock. Collection location UTM: 13 S 0220263 E, 3642980 N.
11/15/2016	Fish Out	1585	168mm	Fish were stocked into the Mimbres River at the NMDGF Mimbres River Property and at Moreno Springs. 1,000 fish were stocked at the Mimbres River Property and the remaining fish were stocked into Moreno Springs. All fish were PIT tagged and weight and length data collected prior to stocking.
5/8/2018	Inventory	442	Various	Broodstock at SNARRC.
11/14/2018	Fish Out	1,017	86mm	Fish were stocked into the Mimbres River in Monument Canyon and McKnight Canyon. Fish were split between the two sites. NMDGF and NMFWCO backpacked or transported the fish in on mules to the sites. All fish were PIT tagged and weight and length data collected prior to stocking.
4/8/2019	Inventory	438	Various	Broodstock at SNARRC.
10/17/2019	Fish out	781	157mm	Group split into approximately half at the Ranger station, half went to Monument Canyon (Mimbres River) packed in by mules and the other half went to McKnight Canyon (the East Fork Mimbres River) backpacked in with

Date	Action	Number of Fish	Size	Comments
				buckets. NMDGF, NMFWCO, and USFS stocked the fish.
10/14/2020	Fish Out	500	92mm	Fish stocked into Monument Canyon.
10/14/2020	Fish Out	521	91mm	Fish stocked into McKnight Canyon.
11/2/2021	Fish Out	200	175mm	Fish stocked into the refugia pond at River Ranch property NMDGF.
11/2/2021	Fish Out	500	175mm	Fish stocked into the Mimbres River on the TNC property.
11/2/2021	Fish Out	573	175mm	Fish Stocked into Cooney Canyon
4/12/2022	Inventory	434	Various	Broodstock at SNARRC.

The 2022 Statewide Fisheries Management Plan approved by the NMDGF has designated the Mimbres River as a native fish management type. The management direction for the Chihuahua chub is to stock the species as needed to maintain populations and expand their range with the intention of creating a self-sustaining population(s) (NMDGF, 2022).

The NMDGF have taken measures since the last USFWS status review to both improve habitat along the Mimbres River and build a pond habitat to establish a refugia population (Figure 5).

NMDGF completed two habitat improvement projects (2016 and 2017) on both NMDGF-owned land and the upper TNC property. The main objective of these habitat improvement projects was to increase habitat complexity and add forcing elements to the stream system to create additional pool habitat for aquatic species. In Spring of 2016, the NMDGF conducted habitat improvements on NMDGF-owned lands immediately adjacent to the Village of Mimbres in Grant County, New Mexico. Work occurred both in and off channel along 1,341 meters (m) (4,400 feet (ft)) of the river and floodplain along the Mimbres River. The project installed woody debris and boulder materials to increase habitat heterogeneity by altering riverine flow velocity which resulted in the formation of 3 small pools (NMDGF 2016). These pools provide habitat for Chihuahua chub and the threatened Chiricahua Leopard Frog *(Rana chiricahuensis)* (NMDGF 2016). On the TNC property in 2017, habitat improvements were constructed on three sections totaling approximately 2,682 m (8,800 ft) of the Mimbres River approximately 4 kilometers (km) (2.5 miles (mi)) north of the Town of Mimbres, New Mexico (Figure 7). The project

resulted in the installation of woody debris, channel alignment structures (boulders), log pour over structures, and cross-channel rock-veins to provide additional habitat for Chihuahua chub and Chiricahua Leopard Frog (NMDGF 2017).

NMDGF is also supporting a *Habitat Use, Movement, and Population Dynamics of Chihuahua chub in the Mimbres River* research study that started in 2021 via funding to New Mexico State University. The following field activities are planned: conduct backpack electrofishing surveys in the Mimbres River to determine seasonal abundance and habitat use, estimate annual mortality rates, and assess the effects of habitat variability on the local colonization and extinction probabilities of Chihuahua chub. Scales and pectoral fin rays will be collected during surveys to age captured Chihuahua chub to determine the age structure, recruitment variability, growth rate, and mortality rate of Chihuahua chub. All Chihuahua chub over 100 mm (3.9 inches) total length will be PIT tagged (Del Piccolo 2021). The project is expected to be completed by the fall of 2023.

The Nature Conservancy in coordination with the USFWS Partners for Fish and Wildlife Program accomplished a habitat improvement project on Moreno Springs in 2015. The project removed accumulated silt and gravel materials from the springs and planted native vegetation to provide chub spawning habitat, refugia for juvenile chub, and more constant water temperatures.

Bear Canyon Dam was refurbished from 2001-2003, and the outlet was modified for installation of a fish screen (1 mm mesh) to prevent escape of nonnative fish from the lake (Consultation# 2011-F-0034). This fish screen is still functioning.

The Heredia Community Ditch diversion dam incorporated changes to the original project proposal to mitigate for potential entrainment of Chihuahua chub in the pipeline and facilitate passage past the diversion dam (Consultation# 2017-F-0930). The head gate was modified to include removable 15.2 cm (0.5 in) mesh fish screens to minimize entrainment of fish and tadpoles in the pipeline. A new 48.7 m (160 ft) fish passage was also constructed around the east end of the diversion dam, across channel from the head gate, to facilitate Chihuahua chub movement around the diversion dam.

2.2.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms):

2.2.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Within the historical range of the Chihuahua chub, stream and wetland habitat have been destroyed or degraded, and loss of this habitat continues today

(Miller and Chernoff 1979, Minckley and Deacon 1991, Contreras-Balderas and Lozano-V. 1994, Propst 1999, Edwards et al. 2002, Contreras-Balderas et al. 2008). Activities such as groundwater pumping, surface water diversions, impoundments, dams, channelization, improperly managed livestock grazing, wildfire, agriculture, mining, road building, timber harvest, and residential development all contribute to riparian and cienega habitat loss and degradation in New Mexico and Mexico (Miller and Chernoff 1979, Minckley and Deacon 1991, Contreras-Balderas and Lozano-V. 1994, Propst 1999, Edwards et al. 2002, Contreras-Balderas et al. 2008). The local and regional effects of these activities are expected to increase with increasing human population, because a larger human population will result in increased development.

Miller and Chernoff (1979) and Propst and Stefferud (1994) provide many examples where historically occupied habitat suffered from periods of drying and reduced surface flow. Diversion of streams for crop irrigation, dam installation, and groundwater pumping are the primary causes of stream drying. In addition, any activity that degrades or eliminates the preferred habitat of the adults (e.g., deep pools, undercut banks) such as removal of woody debris from rivers, trampling of banks by livestock, channelization, removal of riparian vegetation, or increased sedimentation will reduce or eliminate populations. Water pollution from agricultural and municipal sources and overgrazing by livestock also create unsuitable habitat. Because of these developments, Chihuahua chub may be comparatively common only in the remote areas of Chihuahua, Mexico where habitat modification is less common (Propst and Stefferud 1994).

Wildfire

Wildfires are a natural disturbance in forested watersheds. However, since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average frequency during the period 1970–1986. The total area burned is more than six and a half times the previous level (Westerling et al. 2006). In addition, the average length of the fire season during 1987– 2003 was 78 days longer compared to that during 1970–1986, and the average time between fire discovery and control was 29.6 days longer (Westerling et al. 2006). Larger, more frequent, and more severe wildfires accompanying a changing climate may drive conversions in vegetation type from forest to shrub or grassland because of higher tree mortality, limited seed dispersal in larger burn patches, soil damage that reduces seedling establishment, and a changing climate that reduces seedling survival – all of which combine to inhibit forest regeneration (Keeley et al. 2019; Coop et al. 2020). This could result in prolonged post-fire effects to the species as forests regeneration is delayed.

Although prescribed burns are being used in the United States to mimic the historical fire regime and improve watershed conditions on the Gila National Forest, in which the Mimbres Basin occurs, many decades will likely pass

before a natural fire cycle is restored. Fires in the Southwest frequently occur during, or just prior to, the summer monsoon season. As a result, fires are often followed by rain that washes ash-laden debris into streams (Rinne 1996, Brown et al. 2001). It is usually the debris flows, rather than the fires themselves, that impact and sometimes devastate fish populations (Rinne 1996, Brown et al. 2001). Indirect effects of fire also include watershed alteration that can change streamflow, water quality, riparian vegetation, and instream sediment loads, all of which can drastically alter habitat for Chihuahua chub. The population has shown resiliency to extirpation from wildfire, but recent fires have significantly reduced the number of Chihuahua chubs, to an extent that may lead to a population bottleneck (Osborne 2019).

Climate Change

The Southwest has the hottest and driest climate in the U.S. The U.S. Fourth National Climate Assessment suggests that warming temperatures will lead to decreasing snowpack, increasing frequency and severity of droughts, and increasing frequency and severity of wildfires, and these in turn will result in warmer water temperatures, reduced streamflows, and increased risk of fire-related impacts to aquatic ecosystems (Gonzales et al. 2018; Overpeck and Bonar 2021). Aquatic species generally exhibit high vulnerability to climate change due to factors such as expected habitat loss and alterations of specific habitat, and many are at high risk of population declines in the near future (Friggens et al. 2014).

According to the Intergovernmental Panel on Climate Change (IPCC 2021), in "Western North America, future aridification will far exceed the magnitude of change seen in the last millennium." The IPCC (2021) predicts with high confidence that drought conditions in the Southwest will increase in duration and severity, with the predicted magnitude changing depending on the emissions scenario considered. A recent study showed that the current drought is one of the worst in the last 1,200 years and is exacerbated by climate warming (Williams et al. 2020); this study suggested that climate warming will make droughts longer, more severe, and more widespread in the future.

In consultation with leading scientists from the Southwest, the New Mexico Office of the State Engineer prepared a report for the Governor (New Mexico Office of the State Engineer 2006) which made the following observations about the impact of climate change in New Mexico:

1) Warming trends in the American Southwest exceed global averages by about 50 percent;
2) Models suggest that even moderate increases in precipitation would not offset the negative impacts to the water supply caused by increased temperature;

3) Temperature increases in the Southwest are predicted to continue to be greater than the global average;
4) There will be a delay in the arrival of snow and acceleration of spring snow melt, leading to a rapid and earlier seasonal runoff ; and
5) The intensity, frequency, and duration of drought may increase.

Consistent with the outlook presented for New Mexico, Hoerling (2007) states that, relative to 1990–2005, simulations indicate that a 25 percent decline in stream flow will occur from 2006–2030 and a 45 percent decline will occur from 2035–2060 in the Southwest. Seager et al. (2007) show that there is a broad consensus among climate models that the Southwest will get drier in the 21st century and that the transition to a more arid climate is already under way. Only one of 19 models has a trend toward a wetter climate in the Southwest (Seager et al. 2007). Stewart et al. (2005) indicated that timing of spring streamflow in the western United States during the last five decades has shifted so that the major peak now arrives one to four weeks earlier, resulting in less flow in the spring and summer.

Streams occupied by Chihuahua chub have already experienced water loss from diversions and groundwater pumping, and sites once occupied are now dry (Miller and Chernoff 1979, Propst and Stefferud 1994). Provisional data from the U.S. Geological Survey (USGS) gauge site on the Mimbres River indicate that the lowest flows on record since the 2010 Chihuahua chub status review were in June of 2021 and 2022, before the monsoon season (summarized from the USGS Water Data web site, USGS 2022). Most likely streams in Chihuahua, Mexico are also affected by drought. Chihuahua chub occupies small to medium-sized streams; consequently, we would expect them to be more susceptible to drying in the face of an intense or protracted drought. It is anticipated that the effects of climate change will lead to greater demands on scarce water sources while at the same time leading to decreasing water availability in the Chihuahuan desert. Consequently, we anticipate reduced surface water flows from warmer air temperatures alone or from a combination of warmer air temperatures and decreasing precipitation and runoff.

The ancillary effects of increased temperature, such as increased habitat fragmentation (from stream drying), changes in invertebrate prey base (both species composition and availability) (Ries and Perry 1995, Harper and Peckarsky 2006, Bradshaw and Holazpel 2008), increased frequency and intensity of fire (Westerling et al. 2006), additional invasive species (IPCC 2002, Eaton and Scheller 1996), increased susceptibility and mortality from disease (Ficke et al. 2005, Hari et al. 2006), and effects on water quality (e.g., dissolved oxygen, nutrients, pH) (Meisner et al. 1988, Meyer et al. 1999, Ficke et al. 2005) may also have a negative impact on Chihuahua chub. Because water temperature is correlated to air temperature, it is predicted that water temperatures will rise, which may allow warmwater fishes (native and nonnative) to expand their range (Ficke et al. 2005) and potentially invade the

Mimbres basin. See Section 2.2.2.3 Disease or Predation below for a discussion on the effects of introduced species.

2.2.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Although the Chihuahua chub from the Mimbres River may have served as a food source for Native Americans and early settlers (USFWS 1986), now it is protected by regulation from angling in New Mexico. In the United States portion of the range, permits for scientific and educational purposes are issued at the discretion of the State of New Mexico as part of the original 4(d) rule when the Chihuahua chub was federally listed.

However, the species may still be an important food source for people in Mexico. Propst and Stefferud (1994) found evidence of, or witnessed, imaginative techniques for fish capture in Chihuahua. When the researchers returned Chihuahua chub back to the creek after surveys, the children were dismayed, because the "charalitos" were the most desirable food fish in the stream (Propst and Stefferud 1994). The impact of human consumption in Mexico is unknown; however, it is unlikely that there is active protection of this species in Mexico.

2.2.2.3 Disease or predation:

Only two other fish species are known to have historically co-existed with Chihuahua chub in New Mexico: Rio Grande sucker (*Catostomus plebeius*) and beautiful shiner (*Cyprinella formosa*) (Propst and Stefferud 1994). The beautiful shiner has been extirpated from New Mexico (Propst 1999). Chihuahua chub evolved in a fish community where no predatory fish existed and as a result developed no mechanisms to deal with predation from nonnative species. Most likely, Chihuahua chub was the top predator and experienced little or no predation or competition from other species. Introduction of nonnatives is considered a major factor in the decline of all native fish species (Koster 1957, Minckley and Deacon 1991, Miller et al.1989). In the Mimbres River, longfin dace became established in the 1960s (Sublette et al. 1990) and is the most abundant nonnative fish (Table 2 and 3). Nonnative Speckled dace were extirpated from the system following the Silver Fire in 2013. Competition between these two species and Chihuahua chub has not been studied.

Table 2. Survey results of Chihuahua chub, Longfin dace, and Rainbow trout from the NMDGF-owned Mimbres River property permanent sampling site (2013-2022). Data collected during fall monitoring, which consisted of a single electroshocking pass through a 200 meter river segment.

Year	Chihuahua chub abundance	Chihuahua chub CPUE (fish/hr)	Longfin dace abundance	Longfin dace CPUE (fish/hr)	Rainbow trout abundance	Rainbow trout CPUE (fish/hr)	Rio Grande sucker abundance	Rio Grande sucker CPUE (fish/hr)
2013	0	0	0	0	0	0	0	0
2014	5	20.81	37	153.99	0	0	0	0.00
2015	1	3.46	185	639.77	0	0	9	31.12
2016	10	29.32	497	1457	0	0	42	123.13
2017	30	76.11	501	1271.04	0	0	49	124.31
2018	8	20.57	417	1072.29	0	0	12	30.86
2019	11	32.59	97	287.41	0	0	23	68.15
2020	92	234.39	491	1250.96	0	0	54	137.58
2021	12	32.41	43	116.13	0	0	7	18.9
2022	3	4.82	0	0	0	0	1	1.61

Table 3. Survey results of Chihuahua chub, Longfin dace, and Rainbow trout from the TNC McAnally Permanent sampling sites (2013-2022). Data collected during fall monitoring, which consisted of a single electroshocking pass through a 200 meter river segment.

Year	Chihuahua chub abundance	Chihuahua chub CPUE (fish/hr)	Longfin dace abundance	Longfin dace CPUE (fish/hr)	Rainbow trout abundance	Rainbow trout CPUE (fish/hr)	Rio Grande sucker abundance	Rio Grande sucker CPUE (fish/hr)
2013	0	0	0	0	0	0	0	0
2014	11	51.36	73	340.86	0	0	0	0
2015	14	71.79	68	348.72	0	0	9	46.15
2016	23	147.86	70	450	0	0	23	147.86
2017	39	112.41	103	296.88	0	0	34	98
2018	35	105.18	41	123.21	0	0	27	81.14
2019	17	53.87	144	456.34	0	0	42	133.1
2020	27	90.84	110	370.09	1	3.36	39	131.21
2021	5	16.1	18	57.96	0	0	6	19.32
2022	0	0	25	73.23	0	0	8	23.43

Brown trout (*Salmo trutta*) and Rainbow trout (*Oncorhynchus mykiss*) were present in the Mimbres River, and the abundance of both has varied over time (Propst and Paroz 2007), but ash flows following the 2013 Silver Fire eliminated both species from the river. A single Rainbow trout was captured during fall monitoring from 2013-2022 (Table 3) at the TNC permanent site. Three additional Rainbow trout were captured during spring population monitoring in 2021 from randomly selected sites (NMDGF 2022) were all adults (404-463 mm total length) indicating reproduction is not occurring. Subsequent testing of a captured Rainbow trout determined that the fish was a triploid, indicating that Rainbow trout captured after the Silver Fire were

illegally stocked, and the species has not reestablished itself in the river. Rainbow trout are potential predators of and competitors with Chihuahua chub. Nonnative trout are removed from the system if encountered during surveys. Other nonnative fish were uncommon in the Mimbres River (Propst 1999), and most were eliminated after the Silver Fire, with longfin dace being the exception.

In Mexico, nonnative fish recorded in the habitat of Chihuahua chub included black bullhead (*Ictalurus melas*), brown bullhead (*I. nebulosus*), bluegill (*Lepomis macrochirus*), carp (*Cyprinus carpio*), western mosquito fish (*Gambusia affinis*), bullhead minnow (*Pimephales vigilax*), rock bass (*Ambloplites rupestris*), and largemouth bass (*Micropterus salmoides*) (Propst 1990). In the Bustillos basin, black bullhead, brown bullhead, and bluegill were present in 1 or 2 of the 6 sites sampled. In the Guzman basin, mosquito fish was the most abundant nonnative caught in the Santa Maria drainage and was found at 7 of 12 sites sampled. Black bullhead and carp were present in 2 of 12 sites. In the Santa Clara drainage, carp was found in 3 of 9 sites and mosquitofish in 1 of 9. In the Casas Grandes drainage, black bullhead was the most commonly encountered nonnative, present at 6 of 17 sites sampled. Carp, bullhead minnow, mosquito fish, rock bass, bluegill, and largemouth bass were present in 3 or fewer of the 17 sites sampled (Propst and Stefferud 1994). Both Miller and Chernoff (1979) and Propst and Stefferud (1994) cited nonnative species as a threat to Chihuahua chub. Given that Chihuahua chub evolved in a fish community with few species, if additional nonnative species were introduced into their habitat, they may likely have a negative effect on Chihuahua chub.

Anchor worm (*Lernaea cyprinacea*) (Copepoda), also a nonnative species, is an external parasite, and infects a wide range of fishes and amphibians. Anchor worm infection has killed large numbers of fish due to tissue damage and secondary infection of the attachment site (Hoffnagle and Cole 1999) and was responsible for the loss of n=21 Chihuahua chub captured at Moreno Springs and transported to SNARRC for use as broodstock (Burton 1988, Johnson and Jensen 1991). Anchor worm infection was also documented from Chihuahua chub caught in Mexico (Propst and Stefferud 1994). Surveys in the Mimbres River population indicate that anchor worm has been rare there and is not believed to be a concern for the population.

2.2.2.4 Inadequacy of existing regulatory mechanisms:

The Chihuahua chub is federally listed as threatened (45 FR 46053) with a 4(d) rule and State listed as endangered (NMDGF 2006). Specifically, the section 4(d) rule allows "…take in accordance with New Mexico State Laws. The State law prohibits taking of the Chihuahua chub without a collecting permit. These permits are issued by the State and allow take for scientific purposes" (45 FR 46056). This delegates scientific permit authority from USFWS to NMDGF. New Mexico State law provides limited protection to state-endangered species.

The designation provides protection under the New Mexico Wildlife Conservation Act of 1974 (i.e., State Endangered Species Act) (19 NMAC 33.6) but only prohibits direct take of species, except under issuance of a scientific collecting permit. 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 2.38). New Mexico State law further defines bait fish as “those nongame fish which are not otherwise protected by statute or regulation.” (19 NMAC 31.10.7.H); which makes collecting Chihuahua chub for bait fish purposes unlawful. In other words, New Mexico State status as an endangered species conveys protection only from collection or intentional harm to the animals themselves; it does not address habitat protection, indirect effects, or other threats to these species. The 2022 Statewide Fisheries Management Plan approved by the NMDGF has designated the Mimbres River as a native fish management type for Chihuahua chub and Rio Grande sucker, with no plans to use it as a sport fishery.

Because Chihuahua chub is federally listed as threatened, any project with a Federal nexus on the Mimbres River which may affect the species will undergo Section 7 consultation through the New Mexico Ecological Services Field Office. All research activities are regulated by permits issued by the NMDGF. The species is listed as threatened by the Republic of Mexico (Propst 1999), but it is unclear if there is any regulatory protection related to the listing. From the degradation of the habitat that has occurred and the documented desirability of Chihuahua chub as food (Propst and Stefferud 1994), it appears unlikely that any tangible protection is occurring in Chihuahua, Mexico.

2.2.2.5 Other natural or manmade factors affecting its continued existence:

None

2.3 Synthesis

The Chihuahua chubs’ distribution and abundance in the US has declined in recent years due to catastrophic effects of wildfires and subsequent ash flow during monsoons. Currently, the US population consists of a few isolated individuals in the Mimbres River basin, found during surveys in late 2022 and early 2023. The species has not been surveyed in Mexico since the 1990s (USFWS 2010). Given its declining state at that time, lack of regulatory mechanisms, and likely increase of stressors due to climate change, we presume the species condition has continued to decline in Mexico. Numerous conservation actions conducted by NMDGF and USFWS have benefited the species, including obtaining property ownership along the Mimbres River, habitat improvements in stream and riparian areas, and the construction of an off channel refugia pond. Further, the species is maintained in captivity at SNARCC for propagation and release.

Our review of the best available scientific and commercial information indicates that the Chihuahua chub meets the definition of an endangered species, in accordance with Section 3(6) of the ESA. Therefore, with this 5-year status review, we recommend that the Chihuahua chub be uplisted from Threatened to Endangered.

3.0 RESULTS

3.1 Recommended Classification:

Uplist to Endangered

3.2 New Recovery Priority Number (indicate if no change; see 48 FR 43098):

No change.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

Recent genetic studies indicate that the captive population at SNARRC is suffering from a lack of genetic diversity. As such, to maintain a stable and healthy refugia population, future conservation efforts should attempt (where feasible and possible) to cycle new broodstock from wild captured fishes into the SNARRC population.

Future monitoring efforts should elucidate survivorship, recruitment, and health of the population of fishes located in the NMDGF River Ranch Refugia Pond. Wildfires often have catastrophic effects on the wild, Mimbres River populations. Therefore, ensuring the species success in this refugia is likely key.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Chihuahua chub *(Gila nigrescens)*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

Uplist to Endangered

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 2

Approve Jonna Polk Digitally signed by Jonna Polk Date: 2023.08.28 14:22:13 -05'00'