Razorback Sucker
(Xyrauchen texanus)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Region 6
Lakewood, Colorado

5-YEAR REVIEW
Razorback Sucker/*Xyrauchen texanus*

GENERAL INFORMATION

Species: Razorback sucker *Xyrauchen texanus, as currently listed in 50 CFR 17.11*

Date listed: 56 FR 54957, 10/23/1991

FR citation(s): The razorback sucker was first proposed for listing as a threatened species on April 24, 1978 (43 FR 17375). The proposal to list as threatened was withdrawn on May 27, 1980 (45 FR 35410) to comply with provisions of the 1978 amendments to the Endangered Species Act. On March 15, 1989, the U.S. Fish and Wildlife Service (Service) received a petition to list the razorback sucker as endangered. The proposed rule to list the species as endangered was published on May 22, 1990 (55 FR 21154). The final rule listing the razorback sucker as an endangered species was published on October 23, 1991 (56 FR 54957). Recovery goals were developed for the species in 2002 (67 FR 55270-55271).

Classification: Endangered species

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: Critical habitat was designated as 2,776 kilometers (km) (1,725 miles (mi)) of the Colorado River basin on March 21, 1994 (59 FR 13374).

Methodology used to complete the review:
In accordance with section 4(c) (2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened species and endangered species to determine whether its status has changed and it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The Service evaluated the biology and status of the razorback sucker as part of a Species Status Assessment (SSA) to inform this 5-year review.

The SSA report represents our evaluation of the best available scientific information, including the resource needs and the current and future condition of the species. A Service Writing Team, with support from BIO-WEST, Inc. developed the SSA report incorporating scientific expertise in two rounds (Service 2018). First, a Delphi process used input from 47 biologists from state, federal and private organizations working with razorback sucker across its range to rank the importance of threats and conservation actions. Secondly, a Science Team for Scenario Development (Science Team) used the ranked threats and conservation actions to assess current and future condition. We developed five future scenarios of environmental and management conditions to discuss the viability of the species in the future, which were then evaluated by the Science Team.

The Upper Colorado River Endangered Fish Recovery Program (UCREFRP) served as the lead Field Office in Region 6, in coordination with the Grand Junction Fish and Wildlife Conservation Office (FWCO) (Region 6), the San Juan River Basin Recovery Implementation

Program (SJRIP), Arizona Ecological Services Office and Arizona FWCO (all in Region 2). In addition, the Science Team was comprised of species experts who actively work with razorback sucker across its occupied range, from state and federal agencies, including all states in the species range (AZ, CO, UT, WY, NM, NV, CA), the United States Bureau of Reclamation, the National Park Service, the Service, and Western Area Power Administration. Three independent peer reviewers and multiple partner representatives reviewed the SSA report before we used it as the scientific basis to support our decision making-processes for this 5-year review.

FR Notice citation announcing the species is under active review: May 27, 2016; 81 FR 33698-33700; Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 21 Species in the Mountain-Prairie Region

REVIEW ANALYSIS

The razorback sucker (family Catostomidae) is a fish endemic to the warm-water portions of the Colorado River basin in the southwestern United States. Razorback sucker are found throughout the Colorado River basin in both lotic (rapidly moving fresh water) and lentic (still fresh water) habitats, but are most common in low-velocity habitats such as backwaters, floodplains, flatwater river reaches, and reservoirs. Razorback sucker prefer cobble or rocky substrate for spawning, but have been documented to clear sediment away from cobble when conditions are unacceptable and may even spawn successfully over clay beds. Depending on the subbasin, juveniles and adults frequently have access to appropriate habitat throughout the system ranging from backwaters and floodplains to deep and slow-moving pools; however, nonnative fishes are frequently found in such habitats as well. The species is tolerant of wide-ranging temperatures, high turbidity and salinity, low dissolved oxygen, and wide-ranging flow conditions. Razorback sucker typically become sexually mature between three and four years of age, can live for more than 40 years, and spawn multiple times over a lifespan. Razorback sucker consume a large array of food items depending on the environment in which they live.

Stocking and reintroduction programs have brought the species back from near extinction in the upper basin and allowed the species to persist in the lower basin despite a chronic lack of wild recruitment to the adult stage in most populations. Stocked razorback sucker successfully reproduce in portions of both basins and have expanded their range into unstocked locations, such that populations are now present in much of previously occupied habitat.

In the SSA report, we evaluated the current and future condition of the razorback sucker in eight geographic areas which we defined as populations, including four in the upper Colorado River basin (UCRB or ‘upper basin’, defined here as upstream of Lees Ferry, Arizona [Green River, Colorado River, San Juan River, and Lake Powell]) and four in the lower Colorado River basin (LCRB or ‘lower basin’, defined here as downstream of Lees Ferry, Arizona [Lake Mead, Lake Mohave, the Colorado River between Davis and Parker dams [Lake Havasu], and the Colorado River downstream of Parker dam]) (Figure 1). We did not evaluate the condition of the Gila River because a resident population has not been established and stocking of the species has ceased.

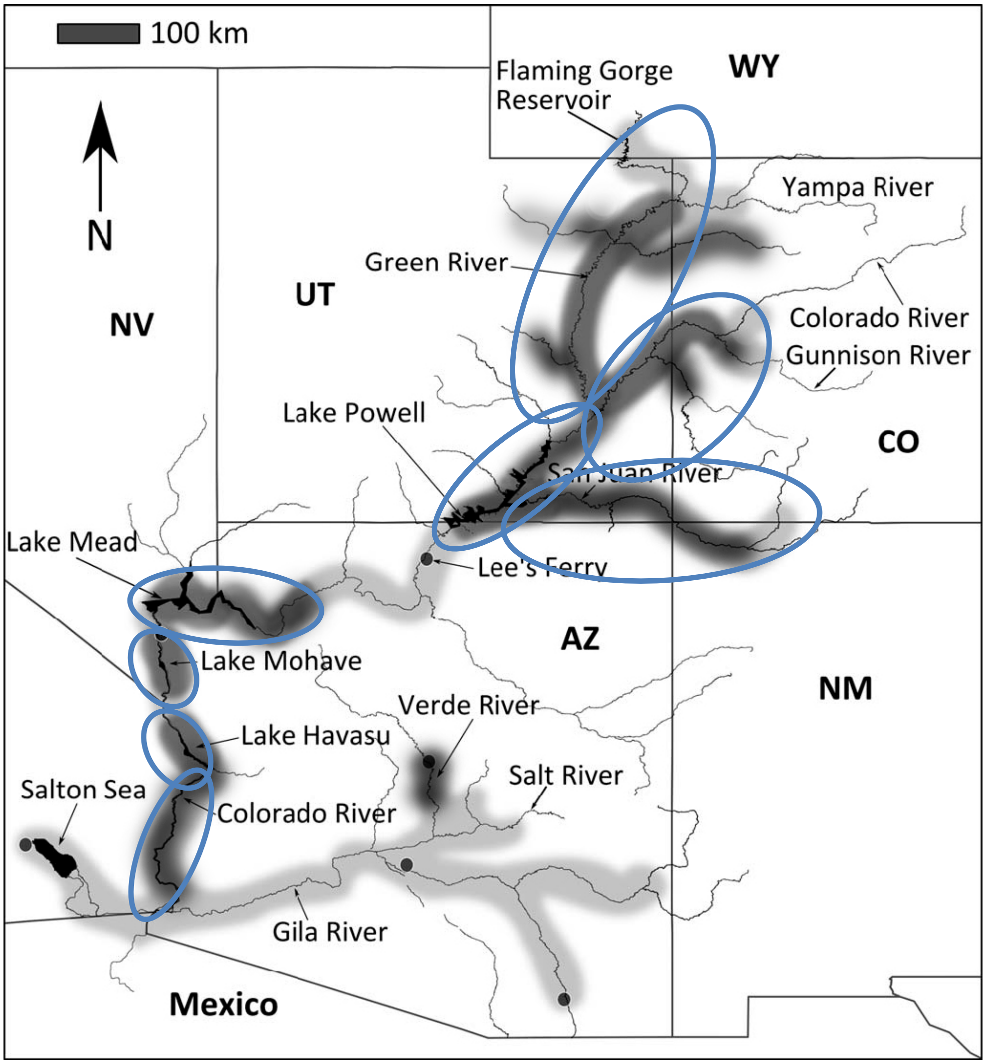

Figure 1. Map of the overall range of the razorback sucker with the 8 populations evaluated in the SSA report circled in blue. Dark shading indicates current overall range and light shading indicates the overall historical range. There are four populations in the upper basin and four populations in the lower basin.

Application of the 1996 Distinct Population Segment (DPS) policy: This section of the 5-year review is not applicable to this species because the razorback sucker was not listed as a DPS nor is there relevant new information for this species regarding the application of the DPS policy. For the time being, we believe continued listing at the species level is the most appropriate way to manage this listed species under the Act.

Updated Information and Current Species Status

The SSA report (Service 2018, entire) summarizes the best available scientific information on the current and future viability of the species and provides the scientific basis for the 5-year review. Current and future condition are described in terms of the conservation biology principles of resiliency, redundancy, and representation. Resiliency describes the ability of individuals and populations to withstand environmental or demographic stochasticity. Redundancy describes the ability of populations to withstand catastrophic events in a way that spreads risk and minimizes potential loss of the species. Redundancy is characterized as having multiple, resilient populations distributed across the range of the species. Representation describes the ability of a species to adapt to changing environmental conditions over time and is characterized by the breadth of genetic and environmental diversity within and among populations (Smith *et al.* 2018).

In the SSA report, we evaluated the current condition for razorback sucker by evaluating current resource conditions, current risks and management actions, and the demographic response of populations. Resources important to razorback sucker include water quality and temperature, variable flow (in lotic habitats only), adequate food, sufficient range and connectivity, and complex habitat (divided into habitat quality and the presence of nonnative fishes in habitats). We categorized resource conditions into four levels, ranging from high (generally highest condition currently available on the landscape and not representative of pre-human conditions) to extirpated (conditions representative of what would cause species extirpation) with two intermediate categories of medium and low (Table 1). Our evaluation of these categories for each populations are summarized in Tables 4 and 5 in the SSA report for each resource and demographic category (Service 2018, p. 53-54).

Table 1. Condition category table used to evaluate the current and future condition for the habitat, or physical needs, of individual razorback sucker, and demographic needs for populations. Conditions for each physical and demographic factor were categorized as either high, medium, low, or extirpated.

	Physical Needs					
	Complex Habitat					
	Habitat	Nonnative presence in habitat	Water quality / Temperature	Variable flow (lotic only)	Adequate food	Range & connectivity
High	Spawning, nursery and adult habitat available throughout the system. Nursery habitat in close proximity to spawning grounds.	Nonnative predators and competitors are rare.	Water temperatures 15 - 25 C and follow a natural pattern. No chronic water quality impairments.	Variation in flow releases or weather patterns provide inter- and intra-annual variability.	High productivity occurring throughout the system.	No impediments or barriers to migration.
Medium	Spawning, nursery and adult habitat present, nursery habitat not close to spawning grounds.	Nonnative competition is present, but nonnative predators are uncommon or controlled.	Temperatures follow seasonal patterns but are depressed (10-15 C). Chronic water quality concerns present at low levels.	Natural and regulated flows provide some of the benefits of natural seasonal fluctuations.	Moderate productivity limits the abundance of food items.	Movement is limited between populations.
Low	Spawning habitat is available, nursery habitat is limited to in-channel formations with channelization present.	Nonnative competitors and predators are common throughout the system.	Low temperatures and water quality concerns reduce growth.	Regulated flows provide volume, but are consistent from year to year.	Reductions in productivity sufficient to reduce body condition of fish.	Barriers restrict migration and reduce access to all necessary habitat.
Extirpated	Habitat for spawning, juveniles and adults compromised by lack of flow or degradation.	All habitat dominated by nonnative predation and/or competition.	Low temperatures or high contaminant levels create toxic conditions.	Highly regulated flows.	Severe reduction in productivity.	Upstream and downstream barriers preclude access to suitable habitat.

	Demographics					
	Adult pop size (wild + stocked fish)	Spawning and larval presence	Recruitment	Dependence on stocking	Genetic integrity	Population stability (wild recruited adults)
High	Population is estimated at >5800 as outlined in 2002 recovery goals.	Large cohorts of larvae are produced at multiple spawning sites on an annual basis.	Greater than 75% of juvenile year classes are present, documented wild fish are abundant	Wild populations do not require supplemental stocking, stocking has ceased.	Genetic diversity is high, relatedness values are low.	Population is self-sustaining without stocking. Recruitment is occurring across many generations.
Medium	Estimates are less than 5800 per population but greater than 500 adults.	Larval presence documented throughout the system annually, in varying density levels.	40-75% of juvenile year classes are present, documented wild fish are common	Stocking present to compensate for a small adult recruitment gap.	Populations show less robust diversity than optimal populations.	Wild population is documented and increasing but must be supplemented with stocked fish.
Low	Population estimates are feasible, but low (~500 adults or less).	Larval presence documented at some locations, in low densities.	25% of year classes are present OR Documented wild fish are uncommon	Recent stocking is the primary source of individuals in the population.	Pronounced reduction in diversity and increase in relatedness, effects not managed through stocking.	Wild adults are documented, but at levels too low to determine population trends.
Extirpated	Individuals are too few to support population estimates.	Larval presence is not documented in the population.	Juveniles are rare, captures are inconsistent.	High mortality of all age classes results in no species presence absent stocking efforts (e.g. Verde River)	Bottlenecks occurring in genetic variation because of high relatedness or high hybridization rates.	No wild adults have been documented and wild populations are assumed extirpated

Resource conditions for the four populations in the upper basin are generally categorized as high to medium condition. The exception is the presence of nonnative fishes in habitat, which is categorized in low condition for most populations; nonnative fishes remain a substantial threat to the species in these populations. Including nonnative fish presence in habitat is designed to assess the degree to which generally otherwise suitable habitat becomes unsuitable or unavailable to razorback sucker because of predation from or competition with nonnative fishes (Table 6 in section 5.1, Service 2018, p. 65-66). The Green and Colorado river subbasins are categorized similarly, but flow variability, temperature regulation, and the availability of naturally functioning floodplain habitats are superior in the Green River. The San Juan River has fewer nonnative fish established in the basin, but less variability in habitat, variable flow and less connectivity because of the formation of a waterfall that blocks all upstream movement from Lake Powell into the San Juan River. Physical resource conditions in Lake Powell are thought to be sufficient for the species, but large-bodied nonnative predators are abundant in the reservoir. Lake Powell is the least studied system in the upper basin; substantial uncertainty remains for both physical resource condition and demographic response.

Resource conditions in the lower basin range from high to low except for the presence of nonnative fishes, which was classified as in extirpated condition for all populations except Lake Mead and the Grand Canyon (Table 7 in section 5.2, Service 2018, p. 72). In all lower basin populations except Lake Mead, competition and predation from nonnative fish predators, which is exacerbated by lack of cover and turbidity, prevents any natural recruitment. Water management and hydropower modify flows in the lower basin, so measures of flow variability are lacking. Unlike the other populations, the habitat, temperature and food resources in the Grand Canyon were ranked low. Unlike the other populations, native fish dominate the Grand Canyon, so nonnative presence in habitat was ranked as high. Habitat, water quality, temperature and food are likely sufficient for all other populations. The geographical ranges for the lower basin populations are large, often including upstream riverine systems; multiple congregations of fish occur within each population, and movement among those congregations is restricted only by the presence of nonnative predators. The Colorado River below Parker dam is limited to a section of river where populations have not established. Mainstem dams prevent upstream movement and limit connectivity between populations.

Current demographic conditions for the upper basin and lower are summarized in Tables 12 and 13 in section 5.3 of the SSA report (Service 2018, p. 85 and 93). The Green River subbasin (measured in the Green and Yampa rivers) currently holds the largest population of adult razorback sucker of approximately 36,000 adults (Zelasko *et al.* 2018). The adult population consists almost entirely of hatchery-reared individuals, but consists of adults from every stocking year class since 2000, demonstrating long-term survival and residency of individuals post-stocking. Adults spawn annually at multiple locations, larval drift has occurred every year since 1993, and first summer recruitment has been documented in floodplain wetlands in each of the past five years (2012 to2017) (Jones *et al.* 2017; Staffeldt *et al.* 2017). Some age-0 fish released from the wetlands in the fall have demonstrated over-winter survival. Despite fulfilling these life history processes, recruitment to the sexually mature adult life-stage is undocumented and perceived as rare, resulting in a low condition for that category.

The razorback sucker population in the Colorado River subbasin has been increasing over the last decade through stocking efforts and is currently estimated at 5,000-8,000 adults (Elverud *in prep*). Spawning and larval presence have been documented in the mainstem Colorado and tributaries above the confluence with the Green River. Untagged juveniles and adults have rarely been encountered, indicating that recruitment from the larval stage to other life stages is not commonly occurring. In both Green River and Colorado River subbasin populations, a lack of recruitment is considered a result of nonnative predation and lack of access to rearing habitat. Because recruitment in both systems is perceived as uncommon, monitoring efforts are not directed at this life stage, which may underestimate this demographic condition.

The San Juan River subbasin adult population has been consistent in size (approximately 3,000), but also consists almost entirely of hatchery-reared individuals (SJRIP 2017). Spawning and larval production has occurred annually for the last 20 years, but there are indications that only a small percentage of the population is participating in spawning. Juvenile survival has rarely been documented. A large population of nonnative channel catfish exists in the San Juan subbasin, but other large-bodied predators have not become established. A waterfall has formed on the San Juan River preventing upstream movement of fish from Lake Powell into the San Juan subbasin.

The Lake Powell population of razorback sucker is not stocked directly but is comprised of individuals stocked in the other three subbasins. Substantial razorback sucker populations (500-2000 adults) have been found residing in Lake Powell (Francis *et al.* 2015; Albrecht *et al.* 2017). Additional research is needed to determine the source of high levels (19 percent or more) of untagged adults in Lake Powell.

In the four upper basin populations, stocking and reintroduction programs have reestablished populations and allowed the species to persist despite a chronic lack of wild recruitment to the adult life stage. It should be noted, however, that we have not had reason to expect a clear signal of recruitment until relatively recently and have therefore not monitored for this demographic process. Prior to 2013, captures of age-0 razorback sucker in the summer and fall were virtually non-existent (i.e. there was little indication that survival beyond the larval life stage was occurring). However, considerable progress has been made in the past five years. For example, in the Green River, spring peak releases from dam operations triggered by the presence of larval razorback sucker and improved floodplain management (i.e. water management and exclusion of large-bodied nonnative fishes), have resulted in the production of 1000s of wild produced age-0 razorback sucker. As upper basin managers bring more managed floodplains on line, we believe the likelihood of detecting wild recruitment should increase.

In the lower basin, demographic conditions vary greatly from the one self-sustaining population (Lake Mead) to a stocked system with low stocking survival (Colorado River below Davis Dam). Razorback sucker are actively recruiting in Lake Mead despite abundant nonnative fishes and lack of active management, leading to high condition scores for most demographic categories (Table 13 in section 5.3 of the SSA report, p. 93). The razorback sucker population in Lake Mead is small (approximately 500 adults), which is not thought to be sufficient to maintain genetic integrity long-term, prompting a lower rating in that category. The Lake Mead population is the only population of razorback sucker that is not dependent on stocking for its persistence over the past decades.

The three remaining razorback sucker populations (Lake Mohave, Lake Havasu, and below Parker Dam) in the lower basin are managed using stocking to maintain populations in the presence of nonnative predators. Larvae are collected annually from Lake Mohave (which also serves as a genetic refuge), reared in off-channel ponds or hatchery facilities and reintroduced as adults. Lake Havasu and the Colorado River below Parker Dam are stocked using traditional methods. These are successful strategies; however, without continued reintroduction, these razorback sucker populations would become extirpated. The Colorado River between Davis and Parker dams (Lake Havasu) is home to a repatriated population of razorback sucker and currently contains the largest population in the lower basin. The mainstem Colorado River below Parker Dam is actively stocked, but survival is low, resulting in populations too small to measure.

Current Viability

Resiliency

When we consolidated the habitat and demographic conditions into an overall evaluation of conditions, all populations were categorized in the medium condition except the Colorado River below Parker Dam, which was categorized in the extirpated condition. So, instead we used summaries of demographic conditions to assess resiliency for each population, essentially averaging condition scores across the demographic conditions to develop an overall assessment, or summary of resiliency, for each population. In the upper basin, there are three populations in low condition and one population in medium condition (Figure 2). In the lower basin, there are two populations in low condition, one population in an extirpated condition, and one population in high condition (Figure 2). Lake Mead in the lower basin was classified as high, largely because it is self-sustaining and does not rely on stocking; the Green River subbasin was classified as medium because of the large adult population and juvenile survival; Colorado and San Juan river subbasins, Lake Powell, Lake Mohave, and Lake Havasu were classified as low because of various impediments to juvenile survival; and the Colorado River below Parker dam was classified as extirpated because stocked individuals have low survival. Lake Mead has the highest resiliency in the system as the only population in which razorback sucker regularly complete all life stages despite abundant nonnative fishes; however, the population size is small. The high categorization for Lake Mead's resiliency is not meant to be suggest pre-anthropogenic conditions, to imply that conditions cannot improve or that the resiliency currently on the landscape is independent of management efforts.

Razorback sucker across the Colorado River basin are actively managed and all the populations except Lake Mead depend on those conservation actions for population resiliency. To summarize current condition, there are eight populations present (Figure 2), spawning and migrating occurs in seven of the eight populations, though many at abundance levels presumed lower than they were historically. Without continued management efforts, all populations would eventually decline to an extirpated condition and those in low or extirpated condition would decline more rapidly.

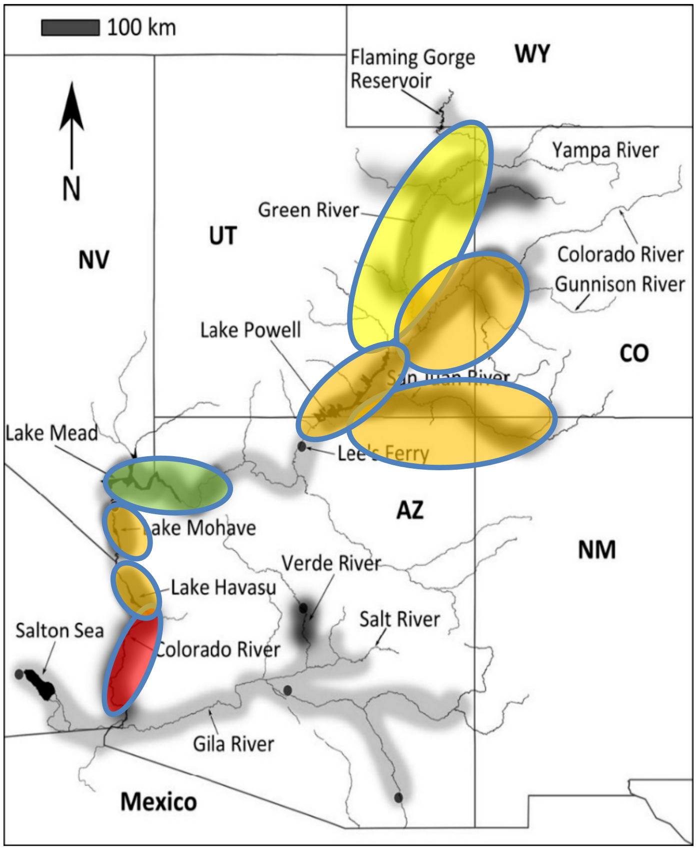

Figure 2. Historical (light gray highlight) and current (dark gray highlight) distribution of the razorback sucker in the upper and lower Colorado River basins with populations colored with the average of current demographic condition. Green represents a population in high condition, yellow is a medium condition, orange is a low condition, and red is an extirpated condition. See Tables 6 and 7 in the SSA report (Service 2018, p. 85 and 93 for more detail on what these categories mean and how they were used to evaluate current condition.

Representation

Razorback sucker have shown a high degree of plasticity in their ability to inhabit both lotic and lentic habitats and survive a wide range of environmental conditions. The genetics of the upper and lower basin populations are managed to maintain genetic diversity. Lower basin populations, especially in Lake Mohave, show higher genetic diversity and less relatedness than upper basin populations (Dowling *et al.* 2012) which is why Lake Mohave is managed as a genetic refuge. Some hybridization occurs with other native and nonnative suckers, but currently at low levels. Genetic representation both within and among populations is high, but genetic adaptability will remain low as long as stocking is required to maintain populations as adaptive genetic traits are not passed from one generation to another through natural recruitment.

Redundancy

Razorback sucker are widely distributed in eight populations across the Colorado River basin (Figure 2, above), living in multiple habitat types and the species is therefore likely to withstand local or even regional catastrophes. The high genetic diversity present in Lake Mohave is distributed through the lower basin through larval collections and subsequent stocking, providing redundancy. Like resiliency, current redundancy is based on management actions, as most populations contain almost exclusively stocked individuals. Recolonization of catastrophically affected areas would likely occur through direct or indirect stocking efforts as stocked adults commonly migrate between populations in the upper basin and would be expected to recolonize affected areas. In the Green and Colorado river subbasins, most major barriers have been removed or their effects ameliorated by fish passage structures. Barriers to upstream movement remain in the San Juan River subbasin, but fish stocked in the San Juan have been documented in Lake Powell and the Green and Colorado rivers. Stocked individuals are routinely documented to move long distances expanding into appropriate habitat across the basin. Razorback sucker in lower basin populations congregate in specific inflow or spawning areas around the lake, and have been shown to migrate between those areas. However, upstream movement is blocked between populations. Elimination of an entire population would likely require additional management actions reestablish the species in those areas.

Recovery Criteria

Recovery Plan or Outline: *Razorback sucker (Xyrauchen texanus) Recovery Goals: amendment and supplement to the Razorback Sucker Recovery Plan* (Service 2002)

The 2002 Recovery Goals (Service 2002) describe demographic and threats based goals that were based on the best available science at the time of publication. Demographic goals included two demographically stable, recruiting populations of 5,800 adults or more in the upper basin, two demographically stable, recruiting populations of 5,800 adults or more in the lower basin and maintenance of a genetic refuge in Lake Mohave. The Green River and Colorado River subbasins have populations larger than 5,800 adults, but are without significant recruitment and dependent on stocking. The Lake Mead population is a stable, recruiting population, but does not meet the abundance threshold of 5,800 adults. No other populations currently meet the goals as written. The genetic refuge is maintained in Lake Mohave.

Section 4(f) of the Act directs us to develop and implement recovery plans for the conservation and survival of endangered and threatened species unless we determine that such a plan will not promote the conservation of the species. Under section 4(f)(1)(B)(ii), recovery plans must, to the maximum extent practicable, include “objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of [section 4 of the Act], that the species be removed from the list.” While recovery plans provide important guidance to the Service, States, and other partners on methods of enhancing conservation and minimizing threats to listed species, as well as measurable criteria against which to measure progress towards recovery, they are not regulatory documents and cannot substitute for the determinations and promulgation of regulations required under section 4(a)(1) of the Act. Recovery of a species is a dynamic process requiring adaptive management that may, or may not; follow all of the guidance provided in a recovery plan.

Over the past five years, populations have expanded and a number of recovery goals have been addressed by improving flow management, construction of fish screens and passage structures at diversions, expansion of nonnative fish management programs and discussions of activities needed in conservation agreements. Many of the goals that remain unaddressed are thought either to have little impact on the species or have been deemed infeasible. In the Delphi threats ranking by experts used for the SSA report, diseases and parasites (upper basin criterion 9, lower basin criterion 5), hybridization (upper basin criterion 16), and contaminant spills (upper basin criteria 17 and 18) were all deemed non-influential (Service 2018, p. 100-101). In the lower basin, management actions do not address alterations in flow below dams (lower basin criterion 1) or the effects of irrigation canals (lower basin criterion 2), but instead mitigate for them under Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The reservoirs in the lower basin are managed as sport-fisheries and nonnative removal does not occur (lower basin criteria 6 and 7) except for in the Grand Canyon managed by Glen Canyon Dam Adaptive Management Program (GCDAMP).

Since the recovery goals were written in 2002, the best available science regarding razorback sucker has greatly increased, including knowledge about the species and its associated threats. For example, Lake Powell was previously thought to have no recovery value because it was thought to be either a barrier to fish movement, or a site of high mortality for stocked fish. However, populations have now been discovered in Lake Powell and the lake is now considered a potential site for species recovery. In addition, smallmouth bass (*Micropterus dolomieu*), which are currently one of the largest threats to recovery in the Green and Colorado Rivers, are not mentioned in the recovery goals. Important recovery actions have also been expanded since the 2002 Recovery Goals, including larval triggered dam operations and floodplain management in the upper basin. Because the best available science has changed since the 2002 Recovery Goals, we use the SSA report as the appropriate document to evaluate the status of the razorback sucker, rather than the 2002 Recovery Goals.

Threats Analysis (threats, conservation measures, and regulatory mechanisms):

In the SSA, we ranked current and potential future threats and conservation measures using a Delphi process, which we summarize here with respect to the five factors described in section 4 of the Act. The most influential threats to the razorback sucker are nonnative predation (Factor C [disease or predation]) and habitat availability driven by flow regime (Factor A [alteration of habitat]). Water management was similarly impactful as a conservation measure to address habitat availability driven by flow regime. Further, conservation measures were ranked as next most important to the species, including program management and funding, augmentation, nonnative removal, and research and monitoring. The species is currently managed through four programs (UCREFRP, SJRIP, GCDAMP, and LCR MSCP), which work with States, tribal, and federal agencies to provide adequate regulatory protection (Factor D [inadequacy of regulatory mechanisms]). Threats ranked next most impactful include nonnative competition (Factor A and C), habitat changes created by nonnative species (Factor A), changes in water temperature (Factor A), climate change (Factor A and E [other factors]), changes in land use (Factor E), heavy metals contamination (Factor E) and reductions in genetic diversity (Factor E). Threats considered but deemed non-influential include hybridization, parasites and diseases (Factor C), contaminant spills (Factor E), runoff pollution (Factor E), and overutilization (Factor B [overutilization]).

Upper Basin

Since 1988 and 1992 respectfully, the UCREFRP and the SJRIP have funded, implemented, and overseen recovery actions for the conservation of razorback sucker in accordance with the guidance provided by the recovery plan, including utilizing adaptive management techniques to address new threats or stressors as they arose. The UCREFRP and SJRIP provide compliance with ESA and facilitate resolution of conflicts associated with recovery actions.

Multiple management actions have been taken to date to improve razorback sucker populations from previous low levels in the upper basin. Since 2000, over 560,000 razorback sucker have been stocked into the upper basin and stocking continues annually in the Green, Colorado and San Juan Rivers. In 2017, fish stocked in 2000 were still detected in the system.

Current flow recommendations (Holden 1999; Muth *et al.* 2000; McAda 2003) promote inter- and intra-annual variability and contain: 1) provisions for spring peak flow timing to enhance entrainment of larvae in floodplain wetlands, 2) peak flow magnitude / duration / frequency guidelines for channel maintenance and modification 3) and base flows scaled to the magnitude of the spring peaks. In the upper Colorado River mainstem, Coordinated Reservoir Operations (CROS) is an ongoing program implemented by UCREFRP to coordinate bypasses of reservoir inflows to enhance spring flows and improve habitat in the '15-mile reach' which flows through Grand Junction, Colorado upstream of the confluence with the Gunnison River. During the past 26 years, flows have exceeded 'wet' year targets at their desired frequencies, but have fallen short in lower-flow years (Anderson in prep). Flow recommendations were developed for operation of Navajo Dam in 1999, which were designed to mimic the natural hydrograph with intra- and inter-annual variability (Holden 1999). Since implementation, flows increased 47 percent to an annual average daily peak flow of 3,900 cubic feet per second (Lamarra and Lamarra 2016).

Flow recommendations have been evaluated and in some instances refined to incorporate new information. A synthesis of larval razorback sucker captures (1992–2009) from the Green River (Bestgen *et al.* 2011) indicated that spring flow management at Flaming Gorge Dam could be better refined by timing floodplain connection releases to coincide with real-time captures of larval razorback sucker. A Larval Trigger Study Plan (LTSP) was developed to test this hypothesis (LaGory *et al.* 2012). Since 2012, LTSP releases have been coordinated with razorback sucker larval sampling allowing controlled flooding and draining of off-channel wetlands (discussed below).

Management of floodplain wetlands has produced young-of-year razorback documented to survive through their first summer, providing the first real indication that recruitment may be occurring in the upper basin. Implementation of the LTSP (LaGory *et al.* 2012) has shown success through larval entrainment and survival to juvenile size classes in flooded wetlands (Jones *et al.* 2015; Schelly and Breen 2015). From 2013-2018, Stewart Lake floodplain (near

Jensen, Utah) was managed to encourage razorback sucker recruitment in conjunction with LTSP flows. During each annual draining event, young-of-year razorback sucker were captured in a fish trap and released back into the river, with the largest cohort occurring in 2016 (Schelly *et al.* 2016). LTSP represents a major step forward in the recovery of the species. The method of entrainment has been repeated at Johnson Bottom, Sheppard Bottom and Wyasket Lake resulting in varying degrees of success, none of which match the success of Stewart Lake. UCREFRP is poised to renovate another floodplain (the Stirrup on BLM land) in fiscal year 2019; and will collaborate with partners to develop another at the Matheson Wetland Preserve on the Colorado River mainstem near Moab, UT.

Fish screens and fish passages have been constructed to prevent entrainment in canals and allow for migration of native species across the basin. Razorback sucker use of the Government Highline Canal passage alone increased from two individuals in 2013 to 130 razorback sucker in 2017 (Francis and Ryden 2017). Fish screens and passages have been constructed in the Grand Valley Irrigation Company Canal (2002; Colorado River mainstem), Redlands Diversion Canal (2005; Gunnison River), Government Highline Canal (2007; Colorado River mainstem) and in the Hogback Diversion Canal (2013; San Juan River). Fish passages have been constructed at the Tusher Diversion (2016; Green River) and the PNM Weir (2003; San Juan River). The remaining canal with high rates of entrainment (Green River Canal off the Tusher Diversion in the Green River) is scheduled to be screened in fiscal year 2019.

Management of problematic nonnative fish species is a primary activity of the UCREFRP. Procedures for stocking nonnative fishes have been developed and agreements have been signed between the Service and the states of Colorado, Utah, and Wyoming for the Green River and upper Colorado River subbasins (Service 2009). These procedures identify the measures necessary to fully evaluate any species stocked into state waters and ensure that these species will not threaten native species. Similar efforts are underway in the San Juan River subbasin and the state of New Mexico.

In 2015, the UCREFRP published an updated Basinwide Strategy (Martinez *et al.* 2015) focusing on the three most problematic nonnative predatory species (northern pike *[Esox lucius]*, smallmouth bass and walleye *[Sander vitreus]*). In addition to in-stream removal, the Strategy focuses on controlling or eliminating source populations in reservoirs in the basin. Fish escapement devices (i.e. nets) have been installed at Elkhead Reservoir, Highline Lake and Rifle Gap Reservoir and screens are currently planned for Ridgway Reservoir, Red Fleet Reservoir, Starvation Reservoir and Catamount Reservoir. Northern pike control continues in the Yampa and Green rivers specifically implemented through four ongoing projects by the UCREFRP and occurs opportunistically during all other sampling efforts. Smallmouth bass control is targeted in the Green, Yampa, White and Colorado Rivers under six specific projects, and occurs during all other sampling efforts. Instream removal of nonnative fishes currently covers over 600 miles in the basin and is evaluated and adapted annually. The San Juan River subbasin basin is currently devoid of the large-bodied nonnative predators discussed above; removal efforts there focus on channel catfish *Ictalurus punctatus* and common carp *Cyprinus carpio*. Additionally, a fish escapement device was installed at the outlet works of Lake Nighthorse (2011) and a fish screen was installed at Morgan Lake (2018).

Lower Basin

GCDAMP coordinates research and monitoring activities aimed at protecting natural resources of the Colorado River through the Grand Canyon. The LCR MSCP has been completing conservations actions to improve razorback sucker populations since 2005 and is authorized to continue through 2055. LCR MSCP coordinates conservation of multiple species (including razorback sucker) from the Lake Mead inflow to the border with Mexico and provides compliance under the Act through a Habitat Conservation Plan (HCP). Management actions include collection of larvae, management of off channel ponds for growth and stocking throughout the system, none of which are designed to improve resiliency but do actively manage redundancy and representation of the species. More than 12 million razorback sucker have been stocked into the LCRB, 180,727 of which were stocked by LCR MSCP between 2005-2017 at average lengths of 300 mm or more (LCR MSCP 2018). Conservation areas being developed by LCR MSCP primarily as disconnected backwaters for native fishes prioritize (1) delivery of non-native fish-free replacement water and (2) the ability to completely drain and renovate ponds without the use of piscicides (LCR MSCP 2018). Restoration research priorities for backwater development are expected to include researching the screening of water to exclude non-native fishes, maintaining water quality in isolated backwaters, and controlling non-native fish species (LCR MSCP 2018). Nonnative predators are not managed in most LCRB mainstem or reservoir habitats.

Evaluation of Future Condition

In the SSA, we evaluated the future condition for the razorback sucker by evaluating the conditions for the same habitat and demographic resource factors and condition categories used to evaluate current condition for each population, but under five future scenarios. In the SSA report, the future condition for the species is considered over the next 30 years, which is a biologically meaningful timeframe that corresponds to approximately three generations of razorback sucker.

As described in the SSA report (Service 2018, p. 98), a Science Team helped develop plausible future scenarios based on the effectiveness of management actions. The scenarios included two pessimistic scenarios representing reductions in conservation actions and less successful augmentation programs (scenarios 1 and 2), a status quo (scenario 3), and two best-case scenarios, or optimistic scenarios representing naturally recruiting populations (scenarios 4 and 5). The scenarios are summarized below:

- Scenario 1 (pessimistic) – Recovery and conservation actions for razorback sucker are reduced to minimal levels because of funding reductions or program cessation. This scenario assumes elimination of some active and adaptive management actions, and reduction in voluntary management actions for the species, such that many actions are no longer in place to mitigate decreased water availability, future water development, or nonnative fish pressures. This scenario assumes dramatic downscaling of upper basin programs but assumes funding and continuation of lower basin programs through the timeframe(s) considered.
- Scenario 2 (pessimistic) – Recovery actions continue at levels thought to be beneficial to

the species as are currently in place, but augmentation efforts are less effective than currently observed, which results in a reduction in survival of stocked fish. Overall effectiveness of recovery actions is below current success levels.

- Scenario 3 (status quo) – Recovery and conservation actions continue at levels thought to be beneficial to the species (including legally required actions and adaptive/voluntary efforts currently in place) and are effective at reducing some threats. This scenario represents continuation of the status quo with effectiveness of recovery actions, as we currently understand them.
- Scenario 4 (optimistic) – Recovery actions continue at levels thought to be beneficial to the species (including legally required actions and adaptive/voluntary efforts currently in place) and are more effective at reducing threats to a level supporting active recruitment than is currently realized. This scenario assumes reduction of current stressor(s) affecting populations.
- Scenario 5 (optimistic) – Recovery actions support wild populations of razorback sucker (includes legally required actions plus adaptive and voluntary efforts currently in place) which are effective at reducing most threats in the system. This scenario assumes improved effectiveness of recovery actions (effective basin wide nonnative fish suppression, rearing habitat management) to a level where recruitment completely sustains the populations.

Throughout all future scenarios, we assumed that water temperatures will be higher and water availability will decrease. For each of the potential future scenarios, the Science Team members individually predicted the overall effect of a scenario within each population using best professional judgement as described in section 6.2 of the SSA report (Service 2018, p. 104). Predictions of future condition of razorback sucker demographic needs were averaged across needs and across participants and are presented in Figures 33 – 42 in sections 6.2.1-6.2.5 in the SSA report (Service 2018. p. 107-118).

Future Viability

The results of our management-based future scenarios predict future conditions for the species ranging from high to low, with some populations restored to a high condition or returning to the low condition seen in the last half century (Figure 3). Under three of the future scenarios, the overall condition for the razorback sucker improves, but under two scenarios, the species condition decreases. In general, if management actions continue into the future, resiliency will likely continue to improve but if management actions slow or stop, the resiliency of populations, and in turn the redundancy and representation of the species, will likely decrease.

The future scenarios predict a much narrower range of future conditions in the lower basin than in the upper basin populations because of the dominance of nonnative predators and lack of efforts to control them (See Figures 37 and 38 in Section 6.2.6 of the SSA report). Under scenario 5, two populations return to a high condition category. The most dramatic losses in resiliency in the lower basin are predicted in scenario 2, with the loss of stocking effectiveness as stocking is the primary tool used to maintain populations on the landscape. Under this scenario, all four populations in the upper basin fall into the red, extirpated condition in 30 years and all four populations in the lower basin maintain their conditions (Figure 3) Only under scenarios 3 (status quo), 4 (optimistic), and 5 (optimistic) does resiliency increase overall (Figure 3).

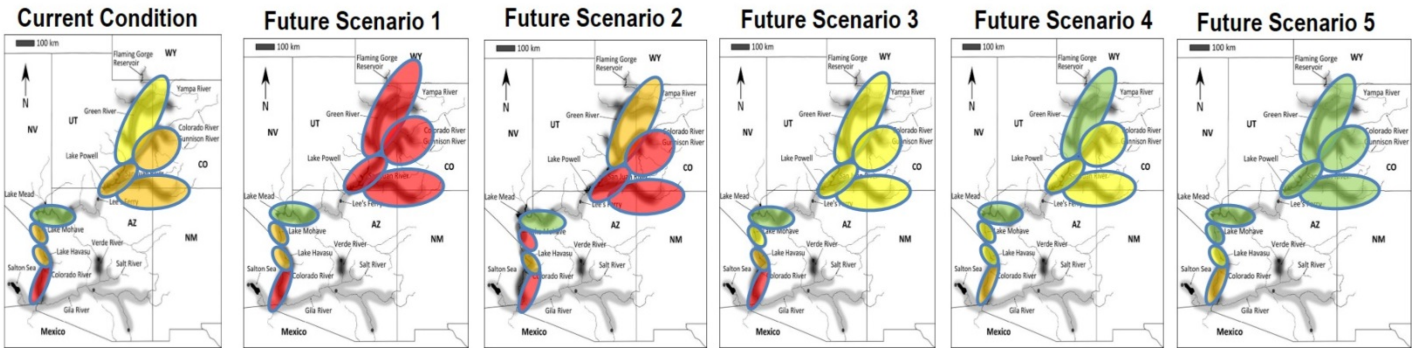

Figure 3. Current and future conditions for the razorback sucker in the upper and lower basins. Green represents a population in high condition, yellow is a medium condition, orange is a low condition, and red is an extirpated condition. See Tables 6 and 7 in the SSA report (Service 2018, p. 85 and 93 for more detail on what these categories mean and how they were used to evaluate current condition.

When we combined future conditions for both basins, predicted future condition ranges from high to low, with a larger distribution of values in the upper basin influencing the overall range (Figure 4). Conservation actions implemented successfully over the last 30 years, improved the current condition of the species from its historical condition. It follows then, that management actions will continue to drive the condition of populations and the species over the next 30 years. Therefore, the five future scenarios captured the range of plausible futures for the continuation and effectiveness of these critically important management actions. If management actions continue and are successful, resiliency of the populations and overall species condition will likely improve. But if management actions slow or stop, population level-resiliency, and species-level redundancy and representation will likely decline.

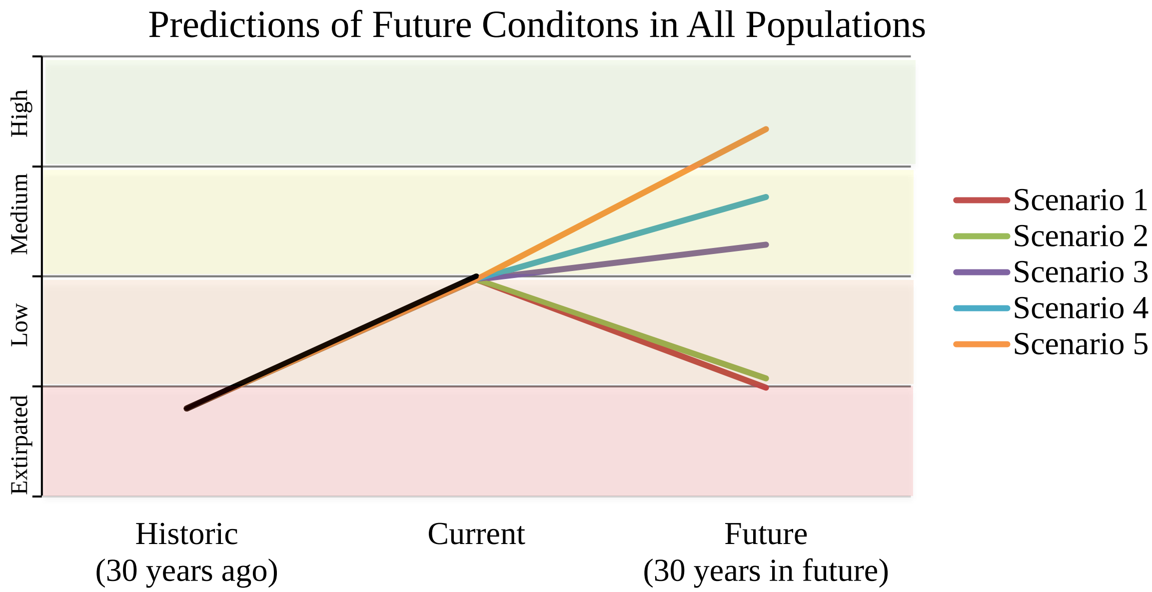

Figure 4. Prediction of razorback sucker population response under the five future (30 years) scenarios for all populations in relation to historic conditions at time of listing (~30 years ago). Table 1 above, provides definitions for the High, Medium, Low, and Extirpated conditions.

SYNTHESIS

Under the Act, an endangered species is defined as any species that is currently "in danger of extinction throughout all or a significant portion of its range." As summarized below, based on the current condition of the razorback sucker as described in the SSA report, emphasizing that management actions are currently ongoing, we conclude that the current risk of extinction is low, such that the species is not in danger of extinction throughout all of its range.

Over the last 30 years, management actions in the upper basin have improved the resiliency of populations, created the redundancy of multiple and well-distributed populations, and maintained representation, largely through genetic diversity. Program partners in both upper basin recovery programs have demonstrated a commitment to recovery over the last 30 years. Current population estimates indicate a population of approximately 36,000 adults in the Green River subbasin (Zelasko *et al.* 2018), 5,000-8,000 adults in the Colorado River subbasin (Elverud in prep) and approximately 3,000 in the San Juan River basin (San Juan River Basin Recovery Implementation Program 2017). Substantial razorback sucker populations (500-2000 adults) have been found residing in Lake Powell (Francis *et al.* 2015; Albrecht *et al.* 2017). Spawning and larval production are occurring across the upper basin in mainstem, tributary and reservoir environments.

In the lower basin, Lake Mead has the highest level of resiliency out of all eight populations, because it supports the only naturally recruiting population on the landscape (Albrecht *et al.* 2010). The Lake Mohave population remains a genetic refuge, from which larvae are harvested annually (Leavitt *et al.* 2017). The largest lower basin population has been reestablished in the Colorado River between Davis and Parker dams (Lake Havasu) at approximately 5000 individuals (Kesner *et al.* 2017). With the exception of Lake Mead, where management is limited to research and monitoring, the lower basin populations are heavily managed.

Primarily due to ongoing management actions, the razorback sucker currently has sufficient individual and population-level resiliency, and species-level redundancy and representation across eight populations distributed between the upper and lower basins, such that the potential loss of one or more populations is not likely to occur now or in the short term. The current resiliency of the naturally-reproducing Lake Mead population, in conjunction with the resiliency and redundancy afforded by management-based populations across both basins decreases the risk to the species from stochastic and catastrophic events, such that the species currently has a low risk of extinction, as long as management actions continue at their current rate and effectiveness. Therefore, we conclude that the razorback sucker does not meet the definition of an endangered species. However, we base this determination on the assumption that management actions will continue in the near term and have the same level of success.

Having determined that the razorback sucker is not in danger of extinction now, we next compared the status of the species to the definition of a threatened species under the Act. As defined by section 3(20) of the Act, a threatened species is any species "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The foreseeable future refers to the extent to which the Secretary of the Department of the Interior can reasonably rely on predictions about the future in making determinations about the future conservation status of the species (U.S. Department of Interior, Solicitor's Memorandum, M-37021 and January 16, 2009). The key statutory difference between a threatened species and an endangered species is the timing of when a species may be in danger of extinction, either now (endangered species) or in the foreseeable future (threatened species).

The current condition of razorback sucker depends on continued management actions. Without significant natural recruitment, adult populations depend entirely on continued captive propagation to persist into the future. Due to this reliance on conservation actions, the five scenarios used to evaluate future condition captured the range of plausible futures for management actions, ranging from cessation in the upper basin, and reduced effectiveness, to improved effectiveness. Over the next 30 years, only under the status quo (Scenario 3) and two optimistic scenarios (Scenarios 4 and 5) do conditions for the razorback sucker improve. Future conditions decline in the two pessimistic scenarios due to the reduction in extent or effectiveness of management actions. So given the uncertainty and risk associated with the continuation and effectiveness of management actions, under two of the five future scenarios, the razorback sucker could become an endangered species within the foreseeable future throughout all of its range. Therefore, given the risk to the species associated with the uncertainty of management actions continuing under Scenarios 1 and 2, we determine that the razorback sucker meets the definition of a "threatened" species.

In this 5-year review, we recommend that the razorback sucker be reclassified from an endangered species to a threatened species under the Act. As explained above, we base this determination on the current condition of the eight populations distributed across the upper and lower basins, fully recognizing that the current condition of the razorback sucker depends entirely on management actions, including effective and ongoing stocking efforts. Although only one out of the eight populations currently demonstrates natural recruitment, management actions over the last 30 years have improved the resiliency of populations (resiliency), increased the number, maintained the distribution of populations (redundancy), and maintained genetic diversity (representation). For the purposes of this decision, we assume these actions will continue into the future, but given uncertainty regarding their continuation and effectiveness over the next 30 years, we believe that the razorback sucker is at risk in the future throughout all of its range, so it meets the definition of a threatened species. Our determination underscores the importance of ongoing management actions to the current and future condition of the razorback sucker. Therefore, if at any time management or conservation actions change, such that the condition of the razorback sucker subsequently changes, we will reevaluate this 5-year review recommendation, if necessary. We will also update the SSA report with the best available information regarding the species and management actions, if necessary, before moving forward with our proposed rulemaking. Finally, we will again evaluate the current and future state of management actions as we develop a proposed rule for this species, which will also provide an opportunity for our partners and the public to comment on the management actions

RESULTS

Recommended Classification: *Given your responses to previous sections, particularly section 2.4. Synthesis, make a recommendation with regard to the listing classification of the species*

__X___ **Downlist to Threatened**
______ **Uplist to Endangered**
______ **Delist** (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
______ **No change is needed**

New Recovery Priority Number: 7C

Brief Rationale: We recommend a change in recovery priority number for razorback sucker to 7c. This indicates a species facing a moderate degree of threat and a high recovery potential that is in conflict with economic development. The threat of nonnative predation has been reduced in much of the upper Colorado River basin through nonnative removal and control of source populations, but remains a major threat to the species. Development of nursery habitat and flow management in both basins has reduced threats to habitat. The recovery potential of razorback sucker is high because biological and ecological limiting factors and threats are well-understood. Management actions have been consistently successful in improving species' condition. Razorback sucker is a monotypic genus in the Colorado River basin, representing a highly distinctive gene pool.

Listing and Reclassification Priority Number, if reclassification is recommended *(see 48 FR 43098, September 21, 1983)*

Reclassification (from Threatened to Endangered) Priority Number: _______
Reclassification (from Endangered to Threatened) Priority Number: __7C___
Delisting (Removal from list regardless of current classification) Priority Number: ____

Brief Rationale: See above

RECOMMENDATIONS FOR FUTURE ACTIONS - The UCREFRP, SJRIP and LCR MSCP develop annual work plans through adaptive management (Recovery Implementation Program Recovery Action Plan, Long-Range Plan, and Work Plan and Budget, respectively), to minimize and remove threats to the razorback sucker and promote recovery. We recommend these programs continue to be funded and implemented to further the recovery of razorback sucker. Continued demographic improvements are expected through continued stocking and threat removal performed by these programs.

We recommend revising the Service's 2002 Razorback Sucker Recovery Goals to incorporate information gathered since 2002. For example, the recovery goals do not address the threats currently understood from nonnative predators such as smallmouth bass and walleye, nor the importance of floodplain wetland management coupled with spring LTSP dam operations. The population in Lake Powell is not referenced in the recovery goals as the lake was seen as a population sink instead of a potential source habitat. The Service will need to determine how the individuals in Lake Powell contribute to meeting demographic recovery criteria, as appropriate. In addition, the requirement that populations always display positive recruitment (i.e., recruitment that is greater than adult mortality) contradicts the best available information that indicates re-established populations will fluctuate even when recovered.

The actions outlined in LCR MSCPs work plan do not include control of nonnative species, restoring natural flow variability below dams, or a future absent of sustained augmentation (with the exception of the Lake Mead population). The Service's definition of recovery will likely need to recognize the concept of conservation reliance and stress the importance of long term commitments to management in various forms (e.g., flow management, floodplain management, nonnative species control, and quite possible some level of augmentation). The Colorado River is one of the most altered ecosystems in the world. The Service should revise recovery goals for this species in these contexts and based on the experiences and information gathered from the four conservation programs.

REFERENCES

Albrecht, B., P. B. Holden, R. B. Kegerries, and M. E. Golden. 2010. Razorback sucker recruitment in Lake Mead, Nevada-Arizona, why here? Lake and Reservoir Management 26(4):336-344.

Albrecht, B., H. E. Mohn, R. Kegerries, M. C. McKinstry, R. Rogers, T. Francis, B. Hines, J. Stolberg, D. Ryden, D. Elverud, B. Schleicher, K. Creighton, B. Healy, and B. Senger. 2017. Use of inflow areas in two Colorado River basin reservoirs by the endangered razorback sucker (Xyrauchen texanus). Western North American Naturalist 77(4):500-514.

Anderson, D. *In prep.* 15-mile reach programmatic biological opinion review. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen, K. R., G. B. Haines, and A. A. Hill. 2011. Synthesis of flood plain wetland information: timing of razorback sucker reproduction in the Green River, Utah, related to stream flow, water temperature and flood plain wetland availability. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Project numbers 22F and FR-FP. Synthesis final report.

Dowling, T., M. Saltzgiver, and P. Marsh. 2012. Genetic structure within and among populations of the endangered razorback sucker (Xyrauchen texanus) as determined by analysis of microsatellites. Conservation Genetics 13(4):1073-1083.

Elverud, D. *In prep.* Monitoring large-bodied, young-of-year, and larval fishes of the upper Colorado River and the lower Gunnison River, Colorado in response to reoperation of the Aspinall Unit Reservoirs. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T. A., and D. W. Ryden. 2017. Annual operation and maintenance of the fish passage structure at the Redlands Diversion Dam on the Gunnison River. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T. A., D. W. Ryden, and B. J. Schleicher. 2015. San Juan River arm of Lake Powell razorback sucker (Xyrauchen texanus) survey: 2011 interim progress report. U.S. Bureau of Reclamation, Salt Lake City, Utah.

Holden, P. B. 1999. Flow recommendations for the San Juan River. San Juan River Basin Recovery Implementation Program, Albuquerque, New Mexico.

Jones, M. T., C. Smith, and D. Beers. 2017. Middle Green River floodplain sampling. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Project number FR164, 2017 annual report.

Jones, M. T., C. Smith, and D. Beers. 2015. Middle Green River floodplain sampling. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Kesner, B. R., C. A. Ehlo, J. B. Wisenall, and P. C. Marsh. 2017. Comparative survival of repatriated razorback suckers in lower Colorado River reach 3 2014-2016. Marsh & Associates LLC. U.S. Bureau of Reclamation, Lower Colorado River Multi-Species Conservation Program, Boulder City, Nevada.

LaGory, K., T. E. Chart, K. R. Bestgen, S. Wilhite, S. Capron, D. Speas, H. Hermansen, K. T. McAbee, and J. Mohrman. 2012. Study plan to examine the effects of using larval razorback sucker occurrence in the Green River as a trigger for Flaming Gorge Dam Peak Releases. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Lamarra, D., and V. Lamarra. 2016. Spatial and temporal trends in San Juan River habitat. San Juan River Recovery Implementation Program, Albuquerque, New Mexico.

Leavitt, J. B., B. R. Kesner, C. A. Pacey, and P. C. Marsh. 2017. Demographics and monitoring of repatriated razorback sucker in Lake Mohave, 2017 annual report. Lower Colorado River Multi-Species Conservation Program, Boulder City, Nevada.

Lower Colorado River Multi-Species Conservation Program (LCR MSCP). 2018. Final implementation report, fiscal year 2019 work plan and budget, Fiscal year 2017 accomplishment report. U.S. Bureau of Reclamation, Boulder City, Nevada.

Martinez, P., K. Wilson, P. Cavalli, H. Crockett, D. Speas, M. Trammell, B. Albrecht, and D. W. Ryden. 2015. Upper Colorado River basin nonnative and invasive aquatic species prevention and control strategy. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

McAda, C. W. 2003. Flow recommendations to benefit endangered fishes in the Colorado and Gunnison Rivers. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Project Number 54, Final Report.

Muth, R. T., L. W. Crist, K. E. LaGory, J. W. Hayse, K. R. Bestgen, T. P. Ryan, J. K. Lyons, and R. A. Valdez. 2000. Flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Project number FG-53.

San Juan River Basin Recovery Implementation Program (SJRIP). 2017. Population abundance estimates for Colorado pikeminnow and razorback sucker in the San Juan River. San Juan River Basin Recovery Implementation Program, Draft program guidance document.

Schelly, R. C., and M. J. Breen. 2015. Use of Stewart Lake floodplain by larval and adult endangered fishes. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Schelly, R. C., R. R. Staffeldt, and M. J. Breen. 2016. Use of Stewart Lake floodplain by larval and adult endangered fishes. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Project number FR165, 2016 annual report.

Smith, D. R., N. L. Allan, C. P. McGowan, J. A. Szymanski, S. R. Oetker, and H. M. Bell. 2018. Development of a Species Status Assessment Process for Decisions under the U.S. Endangered Species Act. Journal of Fish and Wildlife Management 9(1):302-320.

Staffeldt, R. R., M. S. Partlow, B. R. Anderson, and M. J. Breen. 2017. Use of Stewart Lake floodplain by larval and adult endangered fishes. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Project number FR165, 2017 annual report.

U.S. Fish and Wildlife Service. 2018. Species status assessment report for the razorback sucker Xyrauchen texanus. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U. S. Fish and Wildlife Service. 2009. Procedures for stocking nonnative fish species in the upper Colorado River basin. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

U.S. Fish and Wildlife Service. 2002. Razorback sucker (Xyrauchen texanus) recovery goals, report 2. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

Zelasko, K. A., K. R. Bestgen, and G. C. White. 2018. Abundance and survival rates of razorback suckers Xyrauchen texanus in the Green River, Utah, 2011–2013. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Razorback Sucker/*Xyrauchen texanus*

Current Classification:

Recommendation resulting from the 5-Year Review:

__X__ Downlist to Threatened
______ Uplist to Endangered
______ Delist
______ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: 7C

Review Conducted By: Colorado River Recovery Program Office

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve Noreen E. Walsh Date 9/25/2018

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. Written concurrence from other regions is required and should be documented in the administrative record.