

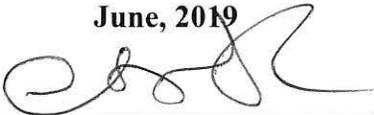
Supplemental Finding for Yaqui Catfish - Fishes of the Rio Yaqui Recovery Plan - 1995

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BACKGROUND INFORMATION

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, “objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list.” It is possible that for some species, however, delisting cannot be foreseen at the time a recovery plan is written. In some rare cases, the best available information is so seriously limited that it is truly not possible to identify delisting criteria. This would be an unusual case, such as one in which the species’ threats are not understood well enough to identify priorities and appropriate actions to remove (or offset) the threats. For example, the natural habitat may have been so reduced for an endangered species that captive propagation and active management is necessary for the life of a reasonable recovery plan. In another example, the population of a long-lived, slow growing species may be so depleted that possible recovery may be beyond the life of a reasonable recovery plan.

A 2006 Government Accountability Office (GAO) audit of the National Marine Fisheries Service’s (NMFS) and U.S. Fish and Wildlife Service’s (USFWS) endangered species recovery programs recommended that the Secretaries of the Department of Commerce and the Interior direct their staff to ensure that all new and revised recovery plans have either recovery criteria evidencing consideration of all five delisting factors or a statement regarding why it is impracticable to do so (GAO 2006). Since the 2006 GAO audit, we have updated our recovery planning and implementation guidance (NMFS and USFWS 2010), and new plans have included determinations regarding the feasibility or possibility of incorporating delisting criteria related to each of the five factors, as recommended by the GAO. Active recovery plans remain, however, that lack delisting criteria and contain either an incomplete determination regarding the

practicability of incorporating delisting criteria, or are silent about the absence of delisting criteria in the recovery plan. In this document, we clarify why it remains impracticable to incorporate delisting criteria for the Yaqui catfish (*Ictalurus pricei*) in the Fishes of the Rio Yaqui Recovery Plan (Recovery Plan).

METHODOLOGY USED TO COMPLETE THE FINDING

U.S. Fish and Wildlife Service personnel associated with San Bernardino NWR (SBNWR) and with the Regional Biological Science Division completed this finding using the Recovery Plan (USFWS 1995), pertinent published literature, USFWS files, and personal knowledge of this species. While there is no formal Yaqui Catfish Recovery Team, subject matter experts representing Arizona Game and Fish Department, Region-2 Ecological Services, Region-2 Fish and Aquatic Conservation Division, SBNWR, the Republic of Mexico, academia, and private interests regularly meet and/or correspond and discuss Rio Yaqui fish recovery. All of these parties have provided personal communications and perceptions regarding recovery of the Yaqui catfish, and that information was used to develop the information contained in this document.

FINDING

The Yaqui catfish was federally-listed as a threatened species on August 31, 1984 (49 FR 34490). Critical habitat is designated to include all aquatic habitats on SBNWR. The primary objective of the 1995 Recovery Plan is to restore the Rio Yaqui fishes as secure and self-sustaining members of the indigenous fish fauna of the aquatic ecosystems in which they once occurred (USFWS 1995). The Recovery Plan defines “secure” as inclusive of legal protection and protection from natural (physical, chemical, or biological) catastrophes as well as technologically and economically possible; “reestablished” as maintaining a self-sustaining population, with no or minimal human intervention; “self-sustaining” as populations that are reproducing naturally and maintaining sizes and structures indicative of persistence for a reasonable period; and “reasonable” in this context as through tens to hundreds of generations.

Conditions for delisting of the Yaqui catfish were identified in the Recovery Plan, and are listed below as Criteria a-c. These conditions and criteria were tentatively identified with the extremely limited information available at the time. Little was known about the ecology of the Yaqui catfish when the species was federally listed (USFWS 1995), and our current knowledge of the species has changed very little since that time. About 98% of the geographic range of this fish exists in Mexico, and a corresponding lack of information (e.g., demographic data), lack of knowledge, and lack of management jurisdiction leads us to determine that developing quantitative delisting criteria for the Yaqui catfish is not practicable at this time. Additionally, delisting is not easily anticipated for this fish because it naturally occurs in a limited geographical range (i.e., approximately 2% of the species’ watershed-wide historical range exists in the U.S.), multiple threats to its survival continue and have increased, and there is an overall lack of historical range in which the species can be potentially recovered, as explained below.

The Yaqui catfish occurs in a limited geographical range restricted to the Pacific Slope of the continental divide, in moderate to large streams 1-4 m deep within basins of the Rio Yaqui, Rio Sonora, Rio Maya, and Rio Fuerte (Miller et al. 2005). Based on specimens, it once occurred in the Rio Casas Grande drainage, but is now extirpated from that system. Surveys in the 1980s and 1990s showed this catfish in decline within its historical range (Hendrickson et al. 1981), and no recent range-wide surveys exist to document the current occurrence of this species. Many threats to this fish continue or have increased, and these include: loss, alteration, and degradation of suitable habitat through the construction of dams used throughout the Rio Yaqui for agricultural and hydroelectric development; the presence of Channel catfish (*Ictalurus punctatus*), a common non-native species that hybridizes with Yaqui catfish; and long-term drought combined with expanding human populations, which are creating increased demand for water for human consumption (Minckley and Marsh 2009).

An overall lack of historical range exists within which the Yaqui catfish can be recovered. As described above, the species once existed in limited watersheds of the arid Pacific Slope in Mexico. These river systems have been severely altered by groundwater withdrawal, conversion of riverine systems to reservoirs, changes in water quality, competition and hybridization with non-native Channel catfish, decreasing precipitation, and a changing climate (Rinne and Minckley 1991, Miller et al. 2005, Minckley and Marsh 2009). A very small percent of unaltered historical range of this fish currently exists to help support potential recovery.

Yaqui catfish were brought into culture by the USFWS in an attempt to establish them in protected wetlands on SBNWR. The Yaqui catfish is known to be difficult to breed and rear in captivity; attempts have not yet been successful since the late 1990s. At this time, no captive populations exist, their current range in Mexico is unknown, and the species is functionally extinct in the wild of the U.S. (Stewart et al. 2017). Potential habitat might still exist in canyon-bound reaches of the Rio Yaqui in Mexico that might be suitable for surveying and also reintroducing Yaqui catfish in the wild upon reestablishing a captive stock. However, the location of these habitats remains currently unknown (Rinne and Minckley 1991).

Early conjecture that the ecology of the Yaqui catfish probably resembles that of the channel catfish (Minckley 1973, 1985) has been found to be incorrect. Adults occur chiefly in deeper water during daylight hours, and move onto shallower riffles and stream runs to feed at night (Miller et al. 2005). Spawning occurs during May and June. Stomach analyses show that Yaqui catfish feed on aquatic invertebrates, other fish, and organic debris (Hendrickson et al. 1981). Very little additional biological information regarding this fish is known.

The following biological requirements (3.0 – 3.5), identified in the Recovery Plan (USFWS 1995) stepdown outline below, must be determined in order to assist with delisting of the Yaqui catfish.

The 1995 Fishes of the Rio Yaqui Recovery Plan identifies the following conditions for delisting Yaqui fishes including the Yaqui catfish:

All the following conditions must be met within currently occupied habitat for a period of 10 years before consideration of delisting for beautiful shiner and Yaqui catfish or downlisting for Yaqui chub and topminnow:”

- a- Secure and protect San Bernardino Valley aquifers so that all artesian and other flows from subsurface sources are perennial. Secure and protect Leslie Creek, Black Draw and Mimbres River, NM watersheds to ensure adequate, perennial flow. And,

Earman et al. (2003) delineated catchment area, recharge and flow rates, storage volumes and other attributes of the underground aquifers for San Bernardino/ Leslie Canyon NWR. Since the mid-1990s, we also are working to identify and quantify the volume of water required to sustain the existing wetland ponds found throughout the refuge. The impact to the aquifer is minimal and the aquifer is actually recharging, and thus is considered to be currently secure and stable.

- b- Eradicate all non-indigenous fish species and other undesirable organisms such as bullfrogs from critical habitat.

Non-indigenous fish species have been successfully eradicated on San Bernardino NWR, Leslie Canyon NWR, and Slaughter Ranch (private property) since the 1990s. Additionally, all non-indigenous fish were removed from ponds on El Coronado Ranch (private property) that supported Yaqui catfish during 2015. U.S. Fish and Wildlife Service personnel have surveyed annually and occasionally biannually and no longer observe any non-indigenous fish species at San Bernardino NWR, Leslie Canyon NWR, House Pond on Slaughter Ranch, and Big Tank on El Coronado Ranch.

American bullfrogs, a non-native amphibian, remain on SBNWR, Slaughter Ranch, El Coronado Ranch, and in adjacent wetlands. We believe this species poses little direct risk to Yaqui catfish, though it may compete for limited food resources. For example, Liu et al. (2017) reported on the analysis and composition of bullfrog (native and nonnative) diets around the world and found that their diets primarily consisted of insects and anurans, including aquatic algal foods. Fish comprised a smaller portion of their diet and was found to not be significant in their model-based exercise (Liu et al. 2017). Other

studies corroborate these findings and report that non-indigenous bullfrogs did not typically affect small-bodied fishes, though some have found that the presence of Mosquitofish may negatively affect amphibians (Blaustein and Kiesecker 2002; Kats and Ferrer 2003; Liu et al. 2017). Non-indigenous bullfrogs/tadpoles may be a prey item for the much larger Yaqui catfish.

- c- Protect critical habitat and other habitats where species of concern occur or are reestablished from human disturbances including excessive grazing, irrigated agriculture, introductions of non-indigenous species and water diversion or removal.

Critical habitat for the Yaqui catfish in the U.S. is designated for all aquatic habitats on San Bernardino NWR. Livestock grazing has been eliminated on the refuge since establishment in 1982, and adjacent lands are not impacted by excessive grazing in the U.S., but this is not the situation in Mexico, where extensive livestock grazing occurs throughout much of the Rio Yaqui watershed. Irrigated agriculture does not occur on surrounding private lands in the U.S., but does occur to a limited extent immediately south of the refuge in Mexico and to a much larger extent throughout the Rio Yaqui watershed. Water use also occurs on private land (Slaughter Ranch) adjacent to SBNWR, where it is used to maintain a park-like atmosphere to encourage public use. The effects of these irrigation activities on the watershed and on Yaqui catfish habitat are poorly known, but related infrastructure (dams, water delivery systems, etc.) has severely impacted natural lotic systems in Mexico, altered groundwater levels, impacted water quality, and allowed salt water infiltration from the Sea of Cortez (Rinne and Minckley 1991, Miller et al. 2005, Minckley and Marsh 2009). No non-indigenous fish species occur in wetlands occupied by Yaqui catfish in the United States, but this is not the situation in Mexico, where many exotic fish species do occur within the Rio Yaqui watershed. Water diversion is not a threat to Yaqui catfish habitat in the U.S., but is a significant threat to watershed in Mexico, where flows in the Rio Yaqui have been severely impacted.

Pertinent to the Yaqui catfish, the 1995 Fishes of the Rio Yaqui Recovery Plan identifies that: “San Bernardino/Leslie Canyon NWR and associated waters, because of their physical size, can only act as a genetic and population refugium. Delisting can occur when recovery in the form of protection of wild populations from threats of hybridization, negative interactions with non-indigenous species or other negative impacts is assured in Mexico and Mexican populations are therefore secure and self-sustaining.”

Developing delisting criteria and the actual delisting of this species does not appear feasible given the lack of quantifiable information and the continuing risks that have been identified. We do not yet understand population demographics, trends, and other data that would enable us to

determine the number of populations or sizes of populations needed to define recovery of this species. There has been no systematic and thorough monitoring for this species since Hendrickson et al. (1981), and no current survey information of existing and potential habitat exists. The absence of demographic data throughout the range of the Yaqui catfish makes the development of objective, measurable criteria relating to occupied habitat impossible. Moreover, we have little knowledge of or influence on the management practices being pursued by officials in Mexico. Threats of hybridization will continue to exist and stocking of both Channel catfish and Flathead catfish will not cease (A. Varela-Romero personal communication). Additionally, Yaqui catfish were found in lotic environments in extremely remote areas of Sonora, Mexico (Rinne and Minckley 1991), but since that time it is unknown whether the species' range is continuing to shrink, expand, or stay the same. Channel catfish and many other exotic fish occur in the same watershed, and it is simply not feasible to implement biological control strategies to counter the negative interactions with non-indigenous species in these areas, especially considering that Mexico is not willing to curb stocking of non-indigenous fish species. Additionally, Mexico has produced no plans to aid in the recovery of the species. Moreover, the Yaqui catfish genetic and population refugium at San Bernardino/Leslie Canyon NWR and associated waters have been declining toward extinction since the captive stock at Uvalde National Fish Hatchery was lost in 2006 (Stewart et al. 2017). Culture methods used by the USFWS have been lost or are otherwise unavailable to guide future potential propagation efforts. Though natural recruitment in Arizona did occur following stocking, it was small and only a few of these fish survived to adulthood. Recently, we examined the otoliths of deceased fish to quantify age. These age assignments indicate that most of the deceased fish were potentially hatchery origin; whereas, a few were likely produced naturally in the habitats at San Bernardino/Leslie Canyon NWR. However, many of these fish did not survive to adulthood and contribute to subsequent spawns and year classes. Our results indicate that the San Bernardino/Leslie Canyon NWR Yaqui catfish population is functionally extinct and that our management reach considering the management practices being pursued in Mexico makes it next to impossible to achieve recovery. The generation of quantifiable data regarding these current knowledge deficiencies could conceivably be utilized to develop objective, quantifiable delisting criteria in the future.

ACTIONS NEEDED

Because 98% of the geographic range of this species exists in the Republic of Mexico, recovery of the Yaqui catfish must occur in that country for the fish to escape extinction. A first step toward potential recovery would be to survey potential wetland habitat in Mexico to determine presence/absence of Yaqui catfish, and plans are underway to collect water samples through monitoring efforts in Sonora, Mexico. These water samples would then be analyzed in the U.S. for eDNA of Yaqui catfish. Once areas having extant populations of Yaqui catfish are identified, planning could be accomplished to protect those occupied habitats as natural refugium for Yaqui catfish and/or to collect a subsample of the catfish population in those habitats and propagate

them in suitable hatcheries in Mexico and the U.S. to produce stock for potential reintroduction efforts in protected waters. Any reintroduction program will require finding and collecting genetically heterozygous Yaqui catfish for potential propagation in a hatchery environment; developing consistent captive propagation techniques and genetic management plan; identifying secure, suitable wetlands in both Mexico and the U.S.; establishing Yaqui catfish into those wetlands; ultimately documenting sustaining self-perpetuating populations; and abolishing the captive propagation and stocking of non-native Channel catfish and Flathead catfish in Sonora, Mexico. While these concepts seem sound, implementation is limited by funding availability, permitting obstacles, and by access limitations into the lotic systems in rural Mexico by researchers. Many of the areas containing potential catfish habitat are under the control of drug cartels who threaten the safety of researchers in Mexico.

In summary, we have reviewed the present incomplete implementation of the 1995 Recovery Plan, pertinent to the Yaqui catfish, and determined that the associated and current absence of data regarding the biology and habitat requirements of Yaqui catfish make it impractical to develop objective, quantifiable delisting criteria at this time.

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