

**ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM**

Animal Abstract

Element Code: AFCJB49080

Data Sensitivity: YES

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Cyprinella formosa*

COMMON NAME: Beautiful Shiner; Yaqui Shiner

SYNONYMS: *Cyprinella formosa mearnsi*, *Notropis formosus*, *Notropis mearnsi*,
Notropis formosus mearnsi

FAMILY: Cyprinidae

AUTHOR, PLACE OF PUBLICATION: Girard, C. 1857. Proceedings of the Academy of Natural Science, Philadelphia [1856] 8:165-213.

TYPE LOCALITY: San Bernardino Creek, Cochise County, Arizona.

TYPE SPECIMEN:

TAXONOMIC UNIQUENESS: There are 22 species of the genus *Cyprinella* in North America. *C. formosa* is one of two species in Arizona, the other species is *C. lutrensis* (Red Shiner), which is not native to Arizona.

No subspecies are currently recognized, however the distinction between the Yaqui basin population and the Guzman basin population. The two populations are separated by the North American Continental Divide. Allozyme data used to examine speciation found considerable variation between drainages (Wood and Mayden 2002). Current mitochondrial and microsatellite results suggest that the Guzman beautiful shiner and Yaqui beautiful shiner are genetically divergent and should be considered distinct subspecies (USFWS 2020). Official changes to classification and nomenclature need to be further explored and validated.

DESCRIPTION: Length up to 8.9 cm (3.5 in.). Body compressed, depth about same as length of head. Snout relatively pointed. Mouth oblique. Lateral line slightly decurved, with 36 to 40 scales. Anal fin-rays 8 or 9. Dorsal and pelvic fin-rays 8. Pharyngeal teeth in a single row, 0, 4-4, 0 (Minckley 1973).

Nonbreeding coloration similar to that of *C. lutrensis*, but more orange on body and metallic or silvery laterally. Dorsolateral scales usually well outlined with melanophores. Males in breeding condition yellow-orange or orange on caudal and lower fins; dorsal fin darkened, with little, if any, milky-white pigment evident. Body bluish, but often masked with an over-all wash of orange, pink, or yellow. Top of head reddened to orange; sides of head brassy to brassy-orange (Minckley 1973).

AIDS TO IDENTIFICATION: Nearly identical to red shiner (*C. lutrensis*), but has orange or yellow back and silver side, and red-orange caudal peduncle. Has 8 anal rays and 34-47 lateral scales, whereas red shiner has 9 anal rays, and 32-36 lateral scales (Page and Burr 1991).

ILLUSTRATIONS: Color photo (Mayden 1989)
B&W photo (Minckley 1973:138)
Color photos (Rinne and Minckley 1991:18)
B&W photo (Wildlife Habitat Management Staff Group 1975:148)

TOTAL RANGE: Historical range included the Rios Yaqui, Casas Grandes, Santa Maria, and Santa Clara drainages in Sonora and Chihuahua, Mexico, the Rio Yaqui (San Bernardino Creek) in Arizona, and the Mimbres River, New Mexico. The Yaqui beautiful shiner was extirpated from the United States in 1969-1970 (Minckley 1973), and population status in Mexico is unknown. Hendrickson et al (1980) surveyed the Rio Yaqui and tributaries in the late 1970's and 1980's, and found the beautiful shiner widespread but locally uncommon in the upper reaches of the river system. No surveys have been conducted since. The species was re-introduced into San Bernardino National Wildlife Refuge (NWR) in the United States in 1990.

RANGE WITHIN ARIZONA: Extirpated from San Bernardino Creek, Cochise County by 1970. Reintroduced into four ponds on the San Bernardino NWR in 1990 and found in two wetlands in 2006. As of 2019, the species occupied about 12 wetlands near and around San Bernardino NWR and Leslie Canyon NWR (USFWS 2020).

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Abarca (1991) discussed some native predators of *C. Formosa*; Mexican garter snakes and a variety of mammals and birds. Also noted were the problematic, introduced fish and bullfrogs of the San Bernardino Creek area. In the United States, population densities appear to be naturally low (USFWS 2020).

REPRODUCTION: Reproduction habits are not well documented. Vives (1993) suggests spawning habits similar to red shiner (*Cyprinella lutrensis*), with egg deposition occurring over small gravel and in crevices. At San Bernardino NWR, captive shiner have been observed laying eggs on submerged structures such as gravel substrates and artificial plants, suggesting that fish likely use vegetation and woody structure in refuge wetlands (USFWS 2020). At San Bernardino NWR reproduction appears to occur principally from May through July (USFWS 2020). Captive juveniles took cover in artificial aquarium plants. Juveniles which left cover were eaten by adults (USFWS 2020). Young and Stewart (in preparation) modeled the relationship between abundance of spawners and recruits and found that density-dependent processes may reduce the number of recruits per spawner at higher population sizes. The best-overall model predicts populations replace less than half the number of adults per year in an established population (Young and Stewart, in preparation, USFWS 2020).

FOOD HABITS: This species feeds on drifting aquatic and terrestrial invertebrates (Rinne and Minckley 1991). This shiner, like its close relatives, is likely an omnivore (Abarca 1991).

HABITAT: This species occurs mainly in pools of small to medium streams and open lentic habitats with sand, gravel and rock bottoms (Minckley 1973, Miller et al. 2005). It has been introduced into man-made ponds. Hendrickson et al. (1980) reported the largest populations found in the Rio Yaqui area were on riffles of smaller streams, or in intermittent pools of creeks that have a high percentage of riffle habitat in wetter periods.

Stewart et al. (2017) quantified site-specific correlates of detection and abundance of United States populations of beautiful shiner in wetlands. Abundance decreased with increasing water temperatures and increasing percent vegetation, and increased with increasing net depth.

ELEVATION: Previously found at approximately 1,158 m (3,800 ft) elevation at San Bernardino Ranch, Cochise County. Currently on the San Bernardino National Wildlife Refuge at 3,750 ft. Found in areas of Mexico from 800 to 1,700 m [2,625 to 5,580 ft.] (Francisco Abarca, pers. comm.).

PLANT COMMUNITY: Riparian plant community.

POPULATION TRENDS: Uncertain. Too much information is lacking from the majority of the species range to determine population trends for the species as a whole. Self-sustaining populations are present at San Bernardino NWR but not at Leslie Canyon NWR. There are no known populations of beautiful shiner in the Mimbres River. No information on the current status of beautiful shiner in Mexico exists, though the species is likely not secure in the country, due to continued water development and habitat destruction in the Yaqui basin.

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: LT with critical habitat (USDI, FWS 1984)
STATE STATUS: 1 (AZGFD, AWCS 2022)
 [1A (AGFD SWAP 2012)]
 [WSC (as *Notropis formosus mearnsi*) (AGFD, WSCA 1996 in prep)]
 [Endangered (as *Notropis formosus mearnsi*) (AGFD, TNW 1988)]
OTHER STATUS: Not Forest Service Sensitive (USDA, FS Region 3 1999, 2013)
 [Forest Service Sensitive, USDA, FS Region 3 1988]
 A, Determined Threatened in Mexico (NORMA Oficial Mexicana NOM-059-SEMARNAT-2010).

Listed Threatened (Secretaría de Medio Ambiente 2000)

[Listed Threatened, Secretaría de Desarrollo Social 1994]

MANAGEMENT FACTORS: Habitat conditions in the United States have likely stabilized for the Yaqui populations of beautiful shiner. Wetland habitats have been restored and expanded, watershed integrity has been maintained, non-native fish species have been eradicated, and conservation easements are in place, with further easements being pursued. However, habitat for the Guzman populations of beautiful shiner are not protected in the Mimbres River. Habitat destruction in Mexico is considered great due to water withdrawal for agricultural and municipal needs (Miller et al. 2005, Fagan et al. 2005). Invasive species interactions continue to threaten beautiful shiner in the Mimbres River and in Mexico. Parasites such as Asian tapeworm, yellow grub, and eye trematodes have been documented on beautiful shiner, but overall health effects are unknown, though likely minor.

As of the 2020 5-year review, the most pressing threat to the United States beautiful shiner populations is the drying of wetland ponds because of reduced artesian flows due to water withdrawal to support construction of border security infrastructure in the San Bernardino Valley. A dynamic linear model relating pumping from Glenn Ranch Well (the well used for border security construction activities) with two wells located on the San Bernardino NWR and one well located on a conservation easement showed a statistically significant negative trend in pressure readings at these three wells correlated to pumping at Glenn Ranch Well. The analysis indicated that activities at Glenn Ranch well can be detected at the other wells as soon as less than a week and for up to six weeks after. The effects of this water withdrawal are already being seen on San Bernardino NWR, with some ponds devoid of water, and refuge staff having difficulty maintaining water levels at 11 of 21 ponds that currently support threatened and endangered fish species. In July 2020, 20 dead beautiful shiner were collected during salvage operations of a drying pond. Testing at the Southwestern Native Aquatic Resources and Recovery Center Southwestern Fish Health Unit indicated no viral, bacterial, or parasitic pathogens from any fish, suggesting that the death of these fish is likely related to changing water conditions and reduced water levels. The long-term effects of continued water withdrawal is unknown (USFWS 2020).

PROTECTIVE MEASURES TAKEN: Critical habitat designated, includes all aquatic habitats of San Bernardino National Wildlife Refuge, Cochise County, Arizona. Portions of the San Bernardino aquifer and the entire Leslie Creek drainage are protected by conservation easements, with further easements being pursued. Wetland habitats have been restored and expanded for the section of the species range which occurs in Arizona. All non-native fish species have been eradicated from San Bernardino NWR, Leslie Canyon NWR, and Slaughter Ranch. Non-native American bullfrogs (*Lithobates catesbeiana*) remain, but are believed to pose little risk to beautiful shiners. Human disturbance is minimized in all critical habitat through restricted access to San Bernardino NWR (USFWS 2020).

Over 700 fish were captured in Mexico and transported to Dexter National Fish Hatchery, New Mexico to establish a captive breeding program. Fishes were re-introduced into the San Bernardino National Wildlife Refuge in May of 1990. The US Fish and Wildlife Service has propagated a captive stock of about 5,000 beautiful shiners of the Guzman lineage at Dexter National Fish Hatchery as of 2020. San Bernardino NWR stock are maintained at the Arizona-Sonora Desert Museum and at the National Aquarium in Washington (USFWS 2020).

SUGGESTED PROJECTS: Watershed-scale survey of the Rio Yaqui and Guzman basin is needed to update knowledge of beautiful shiner, as no new data has been collected since 1994. Determination of the status of subspecies is needed. New recovery plans should be written for each individual Rio Yaqui fish, and separate recovery plans are recommended for the Yaqui and Guzman beautiful shiner, if determined to be distinct subspecies. Research is needed to determine life history characteristics and habitat requirements. Watershed-scale survey of the Rio Yaqui is needed to understand habitat status and species status in Mexico (USFWS 2020).

LAND MANAGEMENT/OWNERSHIP: USFWS, San Bernardino National Wildlife Refuge and Leslie Canyon National Wildlife Refuge, Private. In Mexico, habitat includes private, public and ejido lands.

SOURCES OF FURTHER INFORMATION

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

- Francisco J. Abarca - Arizona Game and Fish Department, Phoenix, AZ.
Bill Radke – US Fish and Wildlife Service, Douglas, AZ.

ADDITIONAL INFORMATION:

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