

# Observations on the Seasonal Distribution of Native Fish in a 10-Kilometer Reach of San Bernardino Creek, Sonora, Mexico

C.O. Minckley

Cuenca los Ojos, Flagstaff, Arizona

**Abstract**—San Bernardino Creek is a northern tributary of the Río Yaqui that originates in the United States and crosses the International Border just east of Douglas, Arizona/Agua Prieta, Sonora and immediately south of San Bernardino/Leslie Canyon National Wildlife Refuge. Six of eight Río Yaqui native fishes occur in this reach: four minnows, a sucker, and a poeciliid. Information is presented on the annual and seasonal distribution of these fishes during 2008–2011.

## Introduction

San Bernardino Creek is a small northern tributary of the Río Yaqui drainage originating in the United States and crossing into Mexico about 16 km east of Agua Prieta and Sonora/Douglas, Arizona. It flows south to join Río Bavispe of Sonora and Río Papigochic of Chihuahua and becomes Río Yaqui, entering the Sea of Cortez near Ciudad Alvero Obregon (Hendrickson and others 1980).

Historically, San Bernardino Creek was a low-elevation, warm-water stream with alternating pools and riffles, undercut banks, and mud-gravel substrates. At one time, it also had considerable cienega habitat. This was before the San Bernardino Land Grant (~1820), after which, overgrazing and aquifer exploitation caused loss of aquatic habitats. These invasive management practices continued into the 1970s until the property was acquired by The Nature Conservancy who transferred the land to U.S. Fish & Wildlife Service (USFWS) creating San Bernardino National Wildlife Refuge (SBNWR) (Cobble 1995). However, by then, the impact of cattle and water mining had dramatically affected the watershed, leaving scars that can be seen today in the incised cienega deposits along San Bernardino Creek (Hendrickson and others 1980; Hendrickson and Minckley 1984; Cobble 1995). Impact on fish populations in the United States was extirpation of Yaqui sucker and near extirpation of Yaqui chub (Minckley and Marsh 2009). The status of fishes in Mexico during that time is unknown. Establishment of SBNWR included development of a management plan that focused on water conservation, aquatic habitat development, and native fishes restoration. These activities were augmented in Mexico with purchase of Rancho San Bernardino by Joe and Valer Austin in 1999, which includes San Bernardino Creek and the drainage to the south. Soon after its purchase, cattle were removed, ponds containing introduced fishes were drained, and a program of

gabion construction began in San Bernardino Creek and associated drainages of Hay Hollow and Silver Creek. These activities removed most introduced fishes and slowed erosion and raised groundwater levels, which resulted in the once barren channel of San Bernardino Creek developing dense stands of cattail and bulrush.

## History of Fish Collections

The San Bernardino Creek drainage has eight species of native fishes including five minnows and one species each of sucker, catfish, and topminnow. The minnows are Mexican stoneroller, *Campostoma ornatum*; Mexican longfin dace, *Agosia sp.*; Mexican roundtail chub, *Gilaminacae*; beautiful shiner, *Cyprinella formosus*; Yaqui chub, *Gila purpurea*; Yaqui catfish, *Ictalurus pricei*; Yaqui sucker, *Catostomus bernardini*; and Yaqui topminnow, *Poeciliopsis sonoriensis* round out the fauna. Type locality for Yaqui catfish, Yaqui topminnow, Yaqui chub, Yaqui sucker and beautiful shiner is San Bernardino Creek at or near the International border (Girard 1857, 1859; E.A. Mearns cited in Snyder 1915).

Fish collections in Mexico from 1880 to 1980 are summarized in Hendrickson and others (1980) and include information on field collections by Simon in 1943, Frost and Hendrickson in 1944, and Miller and Winn in 1950. Fishes taken in these surveys included Yaqui chub, Yaqui catfish, beautiful shiner, Yaqui topminnow, and Yaqui sucker. Records also included carp, *Cyprinus carpio*; black bullhead, *Ameiurus melas*; and largemouth bass, *Micropterus salmoides*. Later, Varela and others (1990) reported rediscovery of Yaqui chub in the creek just south of the International Border and also later, downstream some 4 km from that border (Varela and Campoy-Favela 1996).

Surveys were initiated in San Bernardino Creek from the International Border to ~10 km downstream in May of 2008. This paper reports the distribution of native fish of San Bernardino Creek and some aspects of their biology between May 2008 and December 2011.

## Materials and Methods

Four stations were established along San Bernardino Creek: Station one is four, 25-m reaches in Black Draw, which runs from the International Border south, 3 km; station two is downstream from

---

In: Gottfried, Gerald J.; Ffolliott, Peter F.; Gebow, Brooke S.; Eskew, Lane G.; Collins, Loa C., comps. 2013. Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III; 2012 May 1-5; Tucson, AZ. Proceedings. RMRS-P-67. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

the confluence of Black Draw and Silver Creek; station three is 3 km downstream from station two, and station four is 3 km downstream from station three. Stations two through four were 100 m in length. Stations were sampled with 12, fine-mesh, baited minnow traps and 6 1-m baited Promar hoop nets. All traps were set overnight and run in early morning. Fish collected were identified, counted, and released.

## Results

### Seasonal Distributions

Seasonal distributions are summarized in table 1. At Station one, the most common species was Yaqui topminnow, which was most abundant in fall and decreased in numbers into winter. Yaqui chub was the second most abundant fish and was distributed inversely to topminnow with highest percentages in winter, decreasing into fall. Longfin dace and Mexican stoneroller were present in small numbers throughout the year.

Yaqui topminnow was the most abundant fish overall at station two followed by longfin dace, which was most abundant in summer. Yaqui chub was present in small numbers in fall.

At station three, Yaqui topminnow was the most abundant species with peak numbers in fall. It was also abundant in winter after which decreased into spring and summer. Longfin dace was the second most abundant fish, with largest numbers present in summer and spring. It exhibited smallest numbers in winter and fall. Mexican stoneroller was not abundant but found here more than any other station with largest numbers occurring in summer and smallest numbers in winter. Yaqui topminnow was the most abundant fish at station four and was present in large numbers in fall, followed by summer. The smallest number of topminnow was present in winter and spring. Mexican stoneroller was represented in reduced numbers in all seasons with higher numbers being found in winter and spring (table 1).

### Within Species Distribution

Yaqui topminnow was more abundant at stations two through four with largest numbers taken at station two and smallest at station one. This reflects habitat differences between station one, which has dense stands of cattail and bulrush, and other stations that are more open and more shallow. It might also reflect some level of predation on topminnow by Yaqui chub, which are abundant.

Yaqui chub was most abundant at Station one in winter when large numbers were taken. Numbers decreased into summer/fall. These numbers may reflect spawning, which occurs throughout the year, but appears most common in winter/fall (Minckley 2009, 2010). This would concentrate the fish and also increase number of young-of-year available for capture. During summer, the number of Yaqui chub drops and may reflect a reduction in movements to avoid higher water temperatures and anoxic conditions (Minckley 2010). Currently, Yaqui chub is reported to be restricted to the 3-km reach of station one (Minckley and Marsh 2009; Cobble 1995). This study has extended its range ~6 km and documented a large population in Los Ojitos Spring.

Mexican chub, *Gilaminacae*, was synonymized with roundtail chub, *G. robusta* (Miller 1976) but later resurrected based on molecular differences discovered by Dowling (1998) (Norris and others 2003). As discussed by Minckley (1973), "roundtail" were not thought to occur in San Bernardino Creek, but later he concludes that Mexican chub probably did occur historically in upper San Bernardino Creek based on its connection with Cajon Bonito (Minckley and Marsh,

**Table 1**—Percent of fish taken from four stations on San Bernardino Creek 2008-2011.

	Winter	Spring	Summer	Fall
<b>Station 1, Black Draw</b>				
Yaqui topminnow	35	54	62	79
Longfin dace	t	t	t	t
Yaqui chub	63	45	37	20
Mexican stoneroller	t	t	t	t
<b>Station 2, Confluence</b>				
Yaqui topminnow	88	92	67	89
Longfin dace	12	8	30	10
Yaqui chub	0	0	0	t
Mexican stoneroller	t	t	3	t
<b>Station 3, Los Ojitos</b>				
Yaqui topminnow	79	70	45	94
Longfin dace	16	28	41	5
Yaqui chub	t	t	t	t
Mexican stoneroller	5	t	13	t
<b>Station 4, Las Anitas</b>				
Yaqui topminnow	39	49	60	78
Longfin dace	58	49	39	19
Mexican stoneroller	4	2	t	t

2009). The two Mexican chubs taken in this study represent the first documented collections of this species from San Bernardino Creek.

Numbers of Mexican longfin dace and Mexican stoneroller are much reduced in station one. This is not surprising as both species are adapted to riffle/pool habitat, which is nonexistent in station one.

The last collection of beautiful shiner from the study area was in 1950 (Miller and Winn 1951). It was extirpated from San Bernardino Creek in the United States in 1970 (Minckley 1973; Minckley and Marsh 2005). In 1990, stock taken from Río Moctezuma, Chihuahua, and cultured at Dexter National Fish Hatchery & Technology Center, were repatriated into ponds on the SBNWR (Minckley and Marsh 2005). Today, populations on the refuge are large (B. Radke pers. comm.).

Yaqui sucker was extirpated from San Bernardino Creek in the United States in 1968 (DeMarais and Minckley 1993; McNatt 1974; Minckley 1973). There are no historical records of this fish from the study area although it is abundant in Cajon Bonito and is found in other areas of Mexico (Miller and others 2005; Minckley and Marsh 2009). Thirty-six Yaqui sucker from Cajon Bonito were introduced into San Bernardino Creek in August of 2008 on Station one. Adult individuals of this stocking have been taken but no reproduction has been documented (Minckley 2009; 2010).

## Summary

San Bernardino Creek was surveyed for native fishes from the International Border downstream 10 kilometers during 2008–2011. Six native fish species were collected including Yaqui chub, Mexican chub, Mexican longfin dace, Mexican stoneroller, Sonoran topminnow, and Yaqui sucker. Yaqui chub was most abundant in station one and occurred downstream to station three. It was not taken further downstream but documented in Los Ojitos Spring. Two Mexican chub were taken from Station one, representing the first time this species has been documented from this drainage. Mexican stoneroller occurred throughout the study area. It was rare in station one but common in remaining stations. Mexican longfin dace was also rarely found in station one but was present in large numbers in other stations. Sonora

topminnow was throughout the study area and was more abundant from station two downstream. Depending on season and year, it could be represented by thousands of individuals. Yaqui sucker occurred in station one. Fish distributions were related to spawning, habitat types, and effects of summer water temperature and anoxic conditions.

## Acknowledgment

Joe and Valer Austin are thanked for allowing access to their property in Mexico and supporting this research.

## References

- Cobble, K.S. 1995. Yaqui fishes recovery plan. Albuquerque, NM: U.S. Fish and Wildlife Service, Region 2. 48 p.
- DeMarais, B.D., and W.L. Minckley. 1993. Genetics and morphology of Yaqui chub, *Gila purpurea*, an endangered cyprinid fish subject to recovery efforts. *Biological Conservation*. 66(1): 195-206.
- Dowling, T.E. 1998. Genetic diversity of the *Gila* complex as determined by analysis of mitochondrial DNA. Rept. U.S. Bureau of Reclamation, Salt Lake City, UT. Award No 4-FC-40-15700, Arizona State University, Tempe.
- Girard, C. 1857. Researches upon the cyprinoid fishes inhabiting the fresh water of the United States of America, west of the Mississippi Valley, from specimens in the museum of the Smithsonian Institution. *Proceedings of the Academy of Natural Sciences of Philadelphia*. 8(1856):165-213.
- Girard, C. 1859. *Ichthyology of the boundary*. Washington, DC: U.S. and Mexican Boundary Survey. 85 p.
- Hendrickson, D.A. and W.L. Minckley. 1984. Cienegas: Vanishing climatic communities of the American Southwest. *Desert Plants*. 6(3): 131-175.
- Hendrickson, D.A., W.L. Minckley, R.R. Miller, D.J. Siebert, and P.H. Minckley. 1980. Fishes of the Río Yaqui basin, Mexico and United States. *Journal of the Arizona-Nevada Academy of Science*. 15: 65-106.
- McNatt, R.M. 1974. Re-evaluation of the native fishes of the Río Yaqui in the United States. *Proceedings of the 54<sup>th</sup> Annual Conference of the Western Association of State Game and Fish Commission*: 273-279.
- Miller, R.R. 1976. An Evaluation of Seth E. Meek's Contributions to Mexican Ichthyology. 1976. *Fieldiana Zoology*. 69(1): 1-31.
- Miller, R.R. and H.E. Winn. 1951. Additions to the known fish fauna of Mexico: three species and one subspecies from Sonora. *Journal of the Washington Academy of Science*. 41: 83-84.
- Miller, R.R., W.L. Minckley, and S.M. Norris. 2005. *Freshwater fishes of Mexico*. Chicago, IL: University of Chicago Press. 490 p.
- Minckley, C.O. 2009. Observations on the fishes of San Bernardino Creek Sonora, Mexico, 2008-2009. Final Report. Unpublished completion report on file with the author.
- Minckley, C.O. 2010. Observations on the fishes of San Bernardino Creek, Sonora Mexico in 2010. Final Rept. Unpublished completion report on file with the author.
- Minckley, W.L. 1973. *Fishes of Arizona*. Phoenix, AZ: Arizona Game and Fish Department.
- Minckley, W.L., and P.C. Marsh. 2009. *Inland fishes of the greater Southwest: Chronicle of a vanishing biota*. Tucson: University of Arizona Press.
- Norris, S.M., J.M. Fischer, and W.L. Minckley. 2003. *Gila brevicauda* (Teleostei: Cyprinidae), a new species of fish from the Sierra Madre Occidental of Mexico. *Ichthyological Exploration of Freshwaters*. 14: 19-30.
- Snyder, J.O. 1915. Notes on a collection of fishes made by Dr. Edgar A. Mearns from rivers tributary to the Gulf of California. *Proceedings, U.S. National Museum*. 49. No 2125: 573-586.
- U.S. Fish and Wildlife Service. 2011. Endangered and threatened wildlife and plants; review of native species that are candidates for listing as endangered or threatened; annual notice of findings on resubmitted petitions; annual description of progress on listing actions. *Federal Register* 76(207): 66370-66439.
- Varela-Romero, A., and J.R. Campoy-Favela. 1996. Evaluation of populations of *Cyprinodon macularius*, *Poeciliopsis occidentalis*, *Ictalurus pricei*, *Gila ditaenia* and *Gila intermedia* in shared watersheds between Arizona and Sonora. Tech. Rep. Submitted to Nongame Branch, Arizona Game and Fish Dept., Phoenix, AZ.
- Varela-Romero, A., C. Galindo-Duarte, E. Saucedo-Monarque, L.S. Anderson, P. Warren, S. Stefferud, J. Stefferud, S. Rutman, T. Tibbits, and J. Malusa. 1990. Re-discovery of *Gila intermedia* and *G. purpurea*. *Proceedings, Desert Fishes Council*. 22: 33-34.