Gila River Basin Native Fish Monitoring

2020 Annual Report

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Introduction

Long-term monitoring at multiple spatial scales through time (i.e., temporal) provides important insight on the distribution, abundance, and dynamics of stream fish communities. In 1994, a long-term monitoring program was initiated by the Bureau of Reclamation (BOR) as a requirement imposed by the Fish and Wildlife Service (FWS) to monitor fish populations in selected waters of the Gila River basin due to impacts of the Central Arizona Project (CAP) on federally-listed fishes (FWS 1994, 2001, 2008). For example, the canal and its interconnected channels degraded fish habitat and provides a mechanism for the dispersal of non-native fishes into surrounding aquatic systems. The initial objective of the monitoring program was to provide baseline data on the distribution and abundance of non-native fishes in the CAP canal system and surrounding tributaries. In 2012, BOR and FWS in collaboration with Arizona Game and Fish Department (AZGFD) and New Mexico Game and Fish Department (NMGFD) shifted focus further upstream of the CAP to gather information on the status of wild populations of federal-listed/candidate fishes.

The primary objective of the current monitoring program is to detect the presence of each focal species in each stream and determine their distributional extent within occupied streams. Secondarily, evaluate fish community structure to determine the relative abundance of the focal species within the community of co-occurring fishes. This report summarizes monitoring activities conducted by Marsh & Associates, LLC (M&A) during calendar year 2020 for the Gila River Basin Native Fish Monitoring project (GRBMP). Here, detailed trip summaries with catch data are reported, results are summarized across sub-basins, species distribution maps were constructed, sampling gears were qualitatively evaluated, and a preliminary multivariate analysis of fish community composition was used to reveal complex patterns and relationships.

Surveys were conducted in selected streams of major drainages throughout the Gila River basin (Figure 1) that were not being surveyed by others (e.g., agencies, institutions, and private contractors). The focal species in each stream is one or more of five native species currently listed as threatened or endangered: Gila Chub *Gila intermedia,* Spikedace *Meda fulgida*, Loach Minnow *Tiaroga cobitis*, and Gila Topminnow *Poeciliopsis occidentalis,* plus imperiled Roundtail Chub *Gila robusta*.

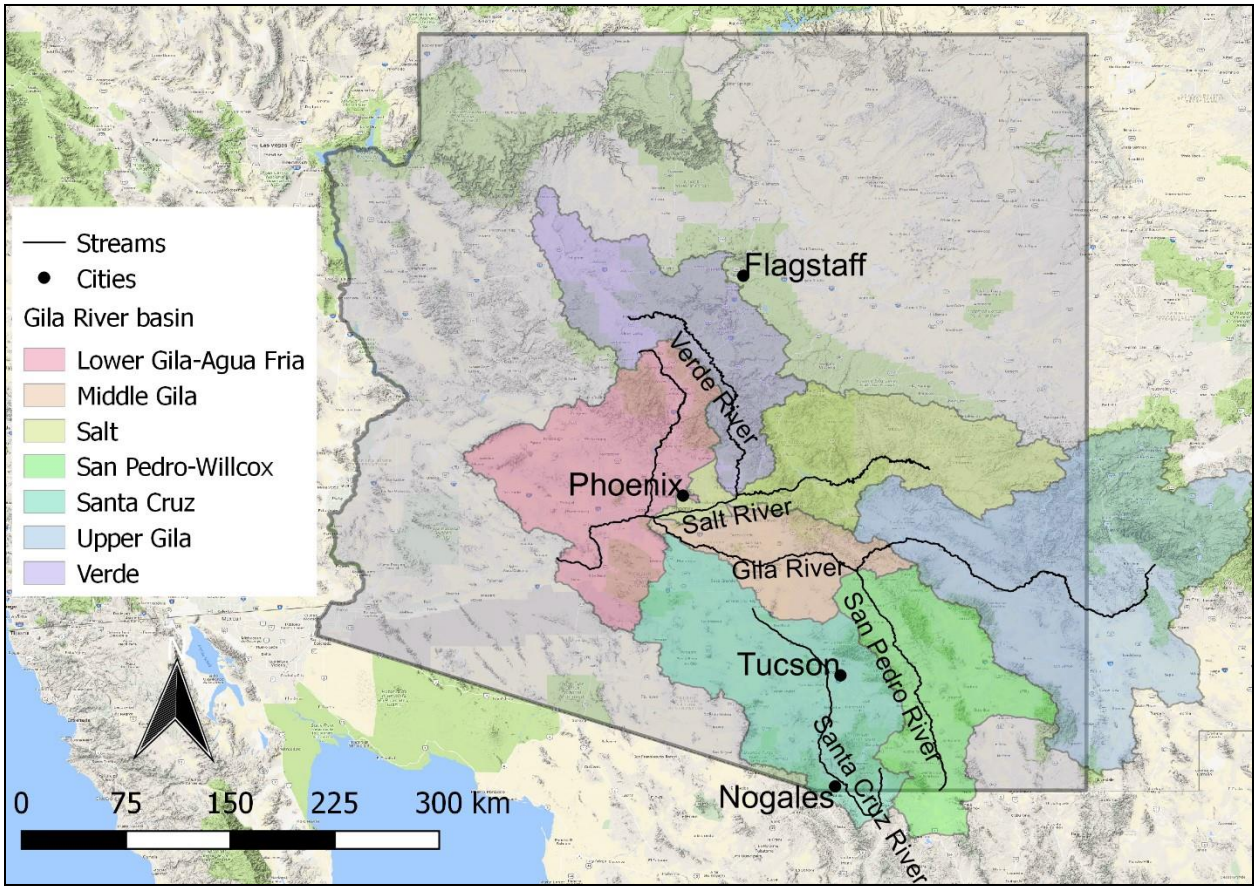

Figure 1. Major drainages of the Gila River basin, where stream surveys were conducted in 2020.

Methods

Sampling

Sampling gear selection was based on the focal species at each site in addition to local habitat characteristics and distance required to access the sampling station. Primary methods of sampling were backpack electrofishing ([BPEF]; Smith-Root LR-20B Electrofisher), Gee style minnow traps (hereafter minnow traps; 10 in x 18 in, 1/8 in mesh), dip nets (1.16 ft x 1 ft, 1/8 in mesh, 1 m sweeps), and seines (20 ft x 6 ft, 0.236 in mesh; 13 ft x 4 ft, 0.078 in mesh; and 12 ft x 4 ft, 0.118 in mesh).

Monitoring protocol followed Clarkson et al. (2011) and any deviations are reported in the trip summaries section below. For clarification, definitions of terms are discussed that are commonly used throughout the report. Stream reach refers to a specific stretch of river denoted by watershed position (i.e., lower, middle, upper), and station refers to a location within a stream reach where sampling occurred. The minimum number of required stations for each stream system was determined based on the length of the stream. Typically, streams that were less than 8 kilometers (km) require one station at minimum, streams that were greater than 8 km but less than 16 km are designated a minimum of two stations, and streams greater than 16 km were assigned three stations. However, minimum stations also are determined based on accessibility, need of sampling, and perennial streamflow.

The priority upon arrival at a station was to determine the presence or absence of the focal species. Opportunistic sampling was conducted through a 500-meter (m) station with focus on the preferred habitat of the focal species. All fishes encountered during this initial pass were identified to species (Table 1), enumerated, and partitioned into age classes (i.e., for large-bodied species; age-0 [young-of-year] and age-1+ [age 1 and older individuals]; small-bodied fishes are not classified and labeled as SB). If the focal species was detected, a 100 m station was established at the point of detection and continued upstream. During this survey, mesohabitats (i.e., riffle, run, and pool) and dry sections were delineated, and species and effort were counted separately within each mesohabitat.

Station lengths were measured using a Garmin 64st GPS unit. The UTM coordinates of the upper and lower boundaries of each reach were recorded in NAD83 datum. Habitat photographs were taken at each station as well as some specimen photos of species of interest. At stations where the focal species was detected and ≥25 individuals were captured, photographs were taken at the upper and lower boundaries of both the upstream and downstream view for future reference of fixed stations.

Deviations from Protocol

The methodology differed for two streams this year: the lower Blue River and Hot Springs Canyon. These streams have been monitored annually as part of native fish restoration projects and those existing protocols were followed. The monitoring protocols for these streams are the same, aside from the station length. In the lower Blue River stations were 200 m and at Hot Springs Canyon they were 100 m in length.

Each station was surveyed using a backpack electrofisher, making a single upstream pass. Stunned fish were captured with dip nets and held in buckets filled with aerated water until they were processed. At the end of each mesohabitat type along the thalweg, all captured fish were processed. At each processing point, fish were identified to species, and counted. All Spikedace, Loach Minnow, and *Gila* spp. captured were measured for total length (mm). Lengths of other species were categorized into general size classes: ≤40 mm and >40 mm for small-bodied fishes (e.g., speckled dace *Rhinichthys osculus*, longfin dace *Agosia chrysogaster*, and red shiner *Cyprinella lutrensis*) and ≤50, 51-100 and >100 mm for large-bodied fishes (e.g., suckers, Roundtail Chub, or the nonnative piscivores).

Table 1. List of fish species encountered during surveys throughout the Gila River Basin in 2020.

Common name	Code	Scientific name
Brown Trout	SATR	*Salmo trutta*
Longfin Dace	AGCH	*Agosia chrysogaster*
Red Shiner	CYLU	*Cyprinella lutrensis*
Common Carp	CYCA	*Cyprinus carpio*
Gila Chub	GIIN	*Gila intermedia*
Headwater Chub	GINI	*Gila nigra*
Roundtail Chub	GIRO	*Gila robusta*
Spikedace	MEFU	*Meda fulgida*
Fathead Minnow	PIPR	*Pimephales promelas*
Speckled Dace	RHOS	*Rhinichthys osculus*

Loach Minnow	TICO	*Tiaroga cobitis*
Sonora Sucker	CAIN	*Catostomus insignis*
Desert Sucker	PACL	*Pantosteus clarkii*
Channel Catfish	ICPU	*Ictalurus punctatus*
Flathead Catfish	PYOL	*Pylodictis olivaris*
Western Mosquitofish	GAAF	*Gambusia affinis*
Gila Topminnow	POOC	*Poeciliopsis occidentalis*
Green Sunfish	LECY	*Lepomis cyanellus*
Largemouth Bass	MISA	*Micropterus salmoides*

Data summary and analyses

Fish capture data were summarized and compiled in tabular form, separately for each stream, that provides numerical, catch-per-unit effort (CPUE), and relative abundance for each species and each age (size) class. Also, a narrative text summarized trip details and fish community composition. Status of the focal species was assessed in contexts of physical habitat conditions, the local fish community, proximate or perceived threats, and other relevant conservation concerns. Solutions implemented (or recommended) to remedy any problems were described, and additional recommendations were offered that might contribute to program improvement. Distribution maps were constructed for each focal species in QGIS (QGIS Development Team 2020).

Results

A total of 49 sampling stations were completed with a focal species being detected at 37 of them (Appendix A, Figure A1). Roundtail Chub were detected at 11 of 12 lower Blue river stations and Gila Chub were detected at 10 of 10 stations including all in Hot Springs Canyon (Appendix A, Figure A2). Loach Minnow were detected at 17 of 28 stations including all 12 in lower Blue River (Appendix A, Figure A3). Spikedace were detected at 16 of 33 stations, also including all 12 in lower Blue River (Appendix A, Figure A4). Gila Topminnow were detected at 8 of 15 stations (Appendix A, Figure A5).

Across all streams, a total of 13,829 individuals and 19 fish species (9 native and 10 non-native) were captured (Table 2; Appendix A, Figures A6-A7). No new taxa were detected for the Gila River basin; however, a chub was detected in the San Francisco River in NM for the first time since 1948 (see page 40). Native taxa accounted for 96% of total catch, while non-native taxa accounted for 4%. Backpack electrofishing was the primary sampling gear, which accounted for 60% (n=8,323) of total catch (Appendix A, Figures A8-A9). Backpack electrofishing was effective at capturing both age classes (i.e., Age-0 and Age-1+) and small-bodied fishes. However, BPEF was not effective in stream reaches with deep pools or high turbidity. Minnow traps were used to target Gila Topminnow in pools and were employed at nine stations, which accounted for 33% (n=4,592) of total catch (Appendix A, Figure A10-A11). Dip-net sweeps were utilized to target Gila Topminnow in the shallow, vegetated margins of streams at six stations and accounted for 6% (n=808) of the total catch (Appendix A, Figure A12). Seining was employed at one station in deeper pools and runs where fish were visually present but dip netting was ineffective, and accounted for less than 1% (n=106) of total catch.

Table 2. Summary of species detected (+) and not detected (-) by stream reach; all in AZ unless otherwise indicated. Focal species for each stream are highlighted in yellow. Species codes are in Table 1.

Stream and reach	SATR*	AGCH	CYLU*	CYCA*	GIIN	GIRO	MEFU	PIPR *	RHOS	TICO	CAIN	PACL	ICPU*	PYOL*	GAAF*	POOC	LECY*	MISA*
La Barge Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Lower Tortilla Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unnamed Drainage #68b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morgan City Wash	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Walker Creek	-	-	-	-	+	-	-	-	+	-	-	+	-	-	-	-	-	-
Fossil Creek	-	-	-	-	-	+	-	-	+	-	+	+	-	-	-	+	-	-
San Francisco River (AZ)	-	+	+	-	-	+	+	+	+	-	+	+	+	+	-	-	-	-
San Francisco River (NM)	-	+	+	+	-	+	+	-	+	+	+	+	+	+	+	-	-	+
Cottonwood Spring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Parker Canyon	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Campbell Blue Creek	+	+	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-
Dry Blue/Pace Creek	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Hot Springs Canyon	-	+	-	-	+	-	-	-	+	+	+	+	-	-	-	-	-	-
Wildcat Canyon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Lower Blue River	-	+	-	-	-	+	+	-	+	+	+	+	-	+	-	-	-	-

*Non-native species

(+) detected

(-) not detected

Trip Summaries

Agua Fria River Basin

Morgan City Wash March 31, 2020

12S NAD83	Lower boundary 1: 381534E, 3744973N	Upper boundary 1: 381247E, 3745297N
	Lower boundary 2: 381116E, 3745365N	Upper boundary 2: 381079E, 3745466N

Morgan City Wash (Maricopa County, AZ) is tributary to the Agua Fria River located just SW of Lake Pleasant (Figure 2). Perennial water exists for 1.5 km in the lower portion of the wash. Gila Topminnow (Sharp Spring lineage) were stocked into Morgan City Wash in 2009 and 2010 and have persisted there ever since (Gray 2018). Desert Pupfish *Cyprinodon macularius* also were stocked but did not successfully establish (Pearson et al. 2013).

On March 31, 2020, Morgan City Wash was accessed from the Agua Fria trailhead. Gee style minnow traps and dip net sweeps were used to sample at this site targeting Gila Topminnow. Fourteen minnow traps were set throughout the 100 m station established in 2016 because habitat there appeared more suitable for Gila Topminnow compared to the 2018 station located further upstream. These minnow traps were set for 2 hours and resulted in capture of 222 Longfin Dace. Because Gila Topminnow were not detected, the station was extended to 500 meters. We set nine additional traps and conducted 23 dip net sweeps in the extended section. These additional efforts resulted in capture of 977 Longfin Dace and two Gila Topminnow (Tables 3-4).

Due to low numbers of the focal species, a second 100-meter station was attempted upstream. Mesohabitat at this station was comprised of a few shallow, spring-fed pools connected by shallow riffles. Four minnow traps were set for just under 2 hours and resulted in capture of 24 Gila Topminnow and 88 Longfin Dace (Table 5). Forty-seven dipnet sweeps resulted in the capture of an additional 11 Gila Topminnow and 194 Longfin Dace (Table 6). The stream was dry approximately 50 meters further upstream. Water temperature and conductivity were recorded at 23 °C and 1,220 µS, respectively. Photographs of the upper and lower extent of the 100 m station are provided below (Figures 3-6).

The previous three GRBMP surveys in 2014, 2016, and 2018 detected 193, 51, and 96 Gila Topminnow respectively (Timmons et al. 2015; Timmons et al. 2017; Burgad et al. 2019). The lower numbers this year could be the result of severe flooding that occurred in autumn 2019. Gila Topminnow continue to persist within Morgan City Wash in low densities and appear to prefer the upper portion of the perennial section of the stream. The 2018 GRBMP survey identified Green Sunfish *Lepomis cyanellus* present upstream of the weir, however no non-native fishes were observed or captured throughout this survey. The instream weir, which previously acted as a fish barrier, is still in need of maintenance as it is no longer preventing upstream movement of non-native fishes.

Table 3. Summary of catch in Morgan City Wash in 500 m station by minnow trap. Total effort was 46.98 net hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
AGCH	N/A	1162	99.91	24.73
POOC	N/A	1	0.09	0.02
Total		**1163**	100.00	24.75

Table 4. Summary of catch in Morgan City Wash in 500 m station by 1 m dip net sweeps. Total effort was 47 dipnet sweeps.

Species	Age	Count	% of total catch	CPUE (fish/net sweep)
AGCH	N/A	37	97.37	1.61
POOC	N/A	1	2.63	0.04
Total		**38**	100.00	1.65

Table 5. Summary of catch in Morgan City Wash in 100 m station by minnow trap. Total effort was 9.167 net hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
AGCH	N/A	88	78.57	9.6
POOC	N/A	24	466.67	2.62
Total		**112**	100.00	12.22

Table 6. Summary of catch in Morgan City Wash in 100 m station by 1 m dip net sweeps. Total effort was 47 dipnet sweeps.

Species	Age	Count	% of total catch	CPUE (fish/net sweep)
AGCH	N/A	194	94.63	4.13
POOC	N/A	11	5.37	0.23
Total		**205**	100.00	25.63

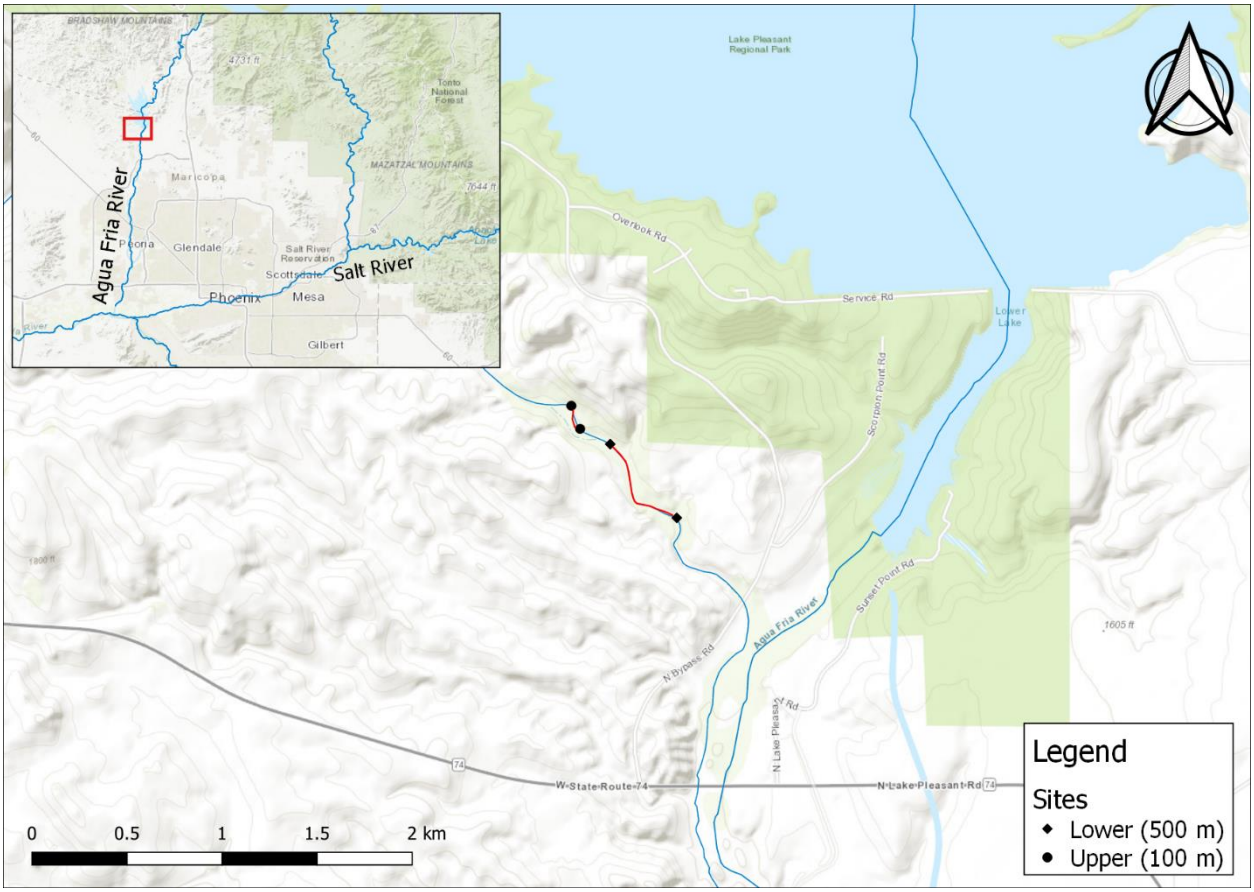

Figure 2. Location of 100 m and 500 m sampling stations in Morgan City Wash, Sampled March 31, 2020.

Figure 3. Downstream to downstream view of the 100 m sampling site in Morgan City Wash.

Figure 4. Downstream to upstream view of the 100 m sampling site in Morgan City Wash.

Figure 5. Upstream to upstream view of the 100 m sampling site in Morgan City Wash Spring.

Figure 6. Upstream to downstream view of the 100 m sampling site in Morgan City Wash Spring.

Salt River Basin

Unnamed Drainage #68b March 3, 2020 & December 14, 2020

12S NAD83 Lower boundary: 464884E, 3710928N Upper boundary: 464677E, 3711307N

Unnamed Drainage #68b (Maricopa County, AZ) is located within Tonto National Forest in the Salt River drainage. It is tributary to Mesquite Creek, which then flows into Tortilla Creek just upstream of Canyon Lake (Figure 7). Perennial water exists in a 200 m long series of tinajas, while the rest of the drainage is intermittent. Gila Topminnow were first detected here in 1985, likely originating from the stocked population (Monkey Spring lineage) in Mesquite Tank #2, which was established in 1982 (Weedman & Young 1997). GRBMP surveys in 2015 and 2017 captured 361 and 731 Gila Topminnow, respectively.

On March 3, 2020, Unnamed Drainage #68b was accessed via a 1.5 km hike on Apache Trail road, due to the road closure at Tortilla Flat. Previous GRBMP surveys have established this 100-meter station. Minnow traps and dip nets sweeps were used targeting Gila Topminnow. Six minnow traps were set for a little over two hours and were dispersed amongst several pool complexes in the 100-meter station. Initial visual surveys did not detect any Gila Topminnow. This station was extended to a total of 500 meters, utilizing dip net sweeps and visual observation. No additional minnow traps were set, as the perennial pools all were located in the 100 m station. No fish were captured. Water temperature and conductivity were recorded at 16°C and 120 µS, respectively. The water was cloudy, which made for poor visibility (Figure 8). All pools were connected at this time and there was flowing water all the way to the confluence with Mesquite Creek.

On December 14, 2020, the site was revisited. Water levels were significantly lower compared to March (Figure 9). The established station at Unnamed Drainage #68b consisted of two small, disconnected pools. A total of six traps were set between them for two hours. No fish were observed or captured in these pools. We then walked upstream in both forks of the drainage until the canyon was no longer passable. An additional six small pools were found; however, no fish were observed and they did not appear to be habitable. Water temperature and conductivity were recorded at 9°C and 270 µS, respectively. Water was low and habitat was restricted, therefore it is unlikely that any Gila Topminnow avoided detection.

It appears that these local populations may have been extirpated. Unnamed Drainage #68b was not affected by the wildfires that impacted other drainages in the Superstition Mountains, however severe flooding last autumn likely led to their demise due to the slot canyon nature of this drainage. The population in Mesquite Tank #2 has since failed as well due to the stock tank being drained, so there is no longer any potential source of Gila Topminnow in this drainage (Gray 2018).

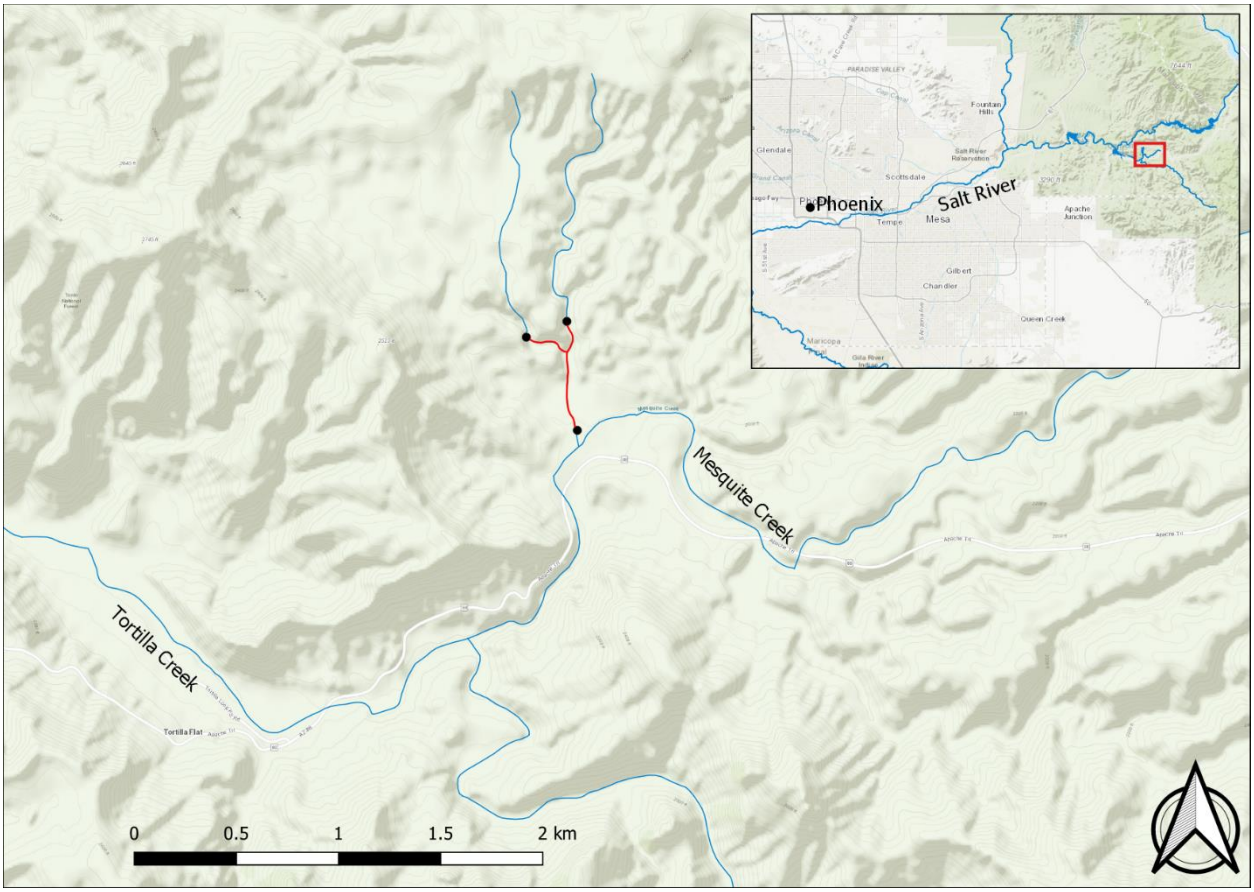

Figure 7. Location of sampling station in Unnamed Drainage #68b, sampled March 3, 2020 & December 14, 2020.

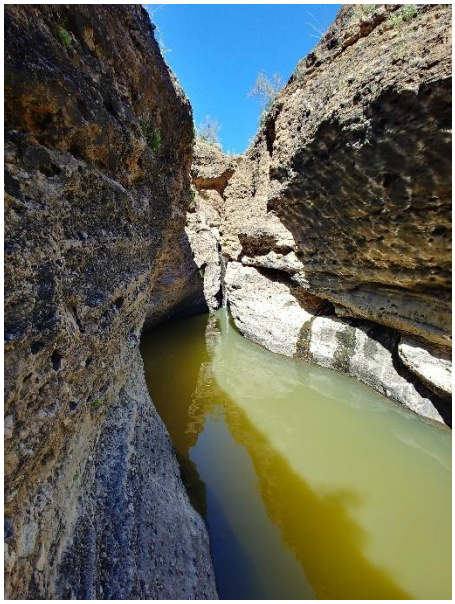

Figure 8. Example of habitat in Unnamed Drainage #68b, sampled on March 3, 2020.

Figure 9. Example of habitat in Unnamed Drainage #68b, sampled on December 14, 2020.

Lower Tortilla Creek March 3, 2020 & December 14, 2020

12S NAD83 Lower boundary: 464236E, 3710001N Upper boundary: 464480E, 3709844N

Tortilla Creek (Maricopa County, AZ) is located within Tonto National Forest in the Salt River drainage and it flows into Canyon Lake. The GRBMP sampling targets the lower reaches of Tortilla Creek, specifically the area around the Mesquite Creek confluence (Figure 10). Gila Topminnow were first detected here in 2005. This population originated sometime after the establishment of Gila Topminnow in Unnamed Drainage #68b as fish likely dispersed downstream during periods of connected flows (Gray 2018). Non-native fishes, such as Green Sunfish and Fathead Minnow *Pimephales promelas*, have also been found in this reach.

On March 3, 2020, Tortilla Creek was accessed by hiking 0.75 km upstream from the parking area at Tortilla Flat. Gee style minnow traps were used to sample at this site targeting Gila Topminnow. A previous GRBMP survey established a 100 m station in 2017 where 1,782 Gila Topminnow were captured. Four minnow traps were set throughout the established station. However, visual surveys and numerous dip net sweeps in the vegetated margins did not detect any topminnow, therefore the station was extended for a total of 500 m. A thorough visual assessment did not detect topminnow. An additional three minnow traps were set in the extended station. The traps fished for four hours. No fish were captured. Habitat at this station was comprised mainly of pool mesohabitat connected by short run and riffle mesohabitats (Figure 11). Water temperature and conductivity were recorded at 14°C and 202 µS, respectively.

On December 14, 2020, the site at Tortilla Creek near the Mesquite Creek confluence was revisited. Tortilla Creek was entirely dry throughout the previously established station. We then walked an additional 1 km upstream of Tortilla/Mesquite confluence and it was dry except for small puddles in the rocks from recent rain. In Mesquite Creek, one pool remained in the slick-rock canyon section approximately 250 meters upstream of the confluence (Figure 12). No fish were observed via a visual survey; however, three traps were set in this pool for three hours and no fish were captured. Water temperature and conductivity in the pool were recorded at 9°C and 370 µS, respectively.

Much like Unnamed Drainage #68b, severe flooding likely had negative impacts on this population, but in addition, the severe drought this past summer caused the normally perennial pools to be dry. Gila Topminnow are still present further upstream in Tortilla Creek where they were stocked in 2017.

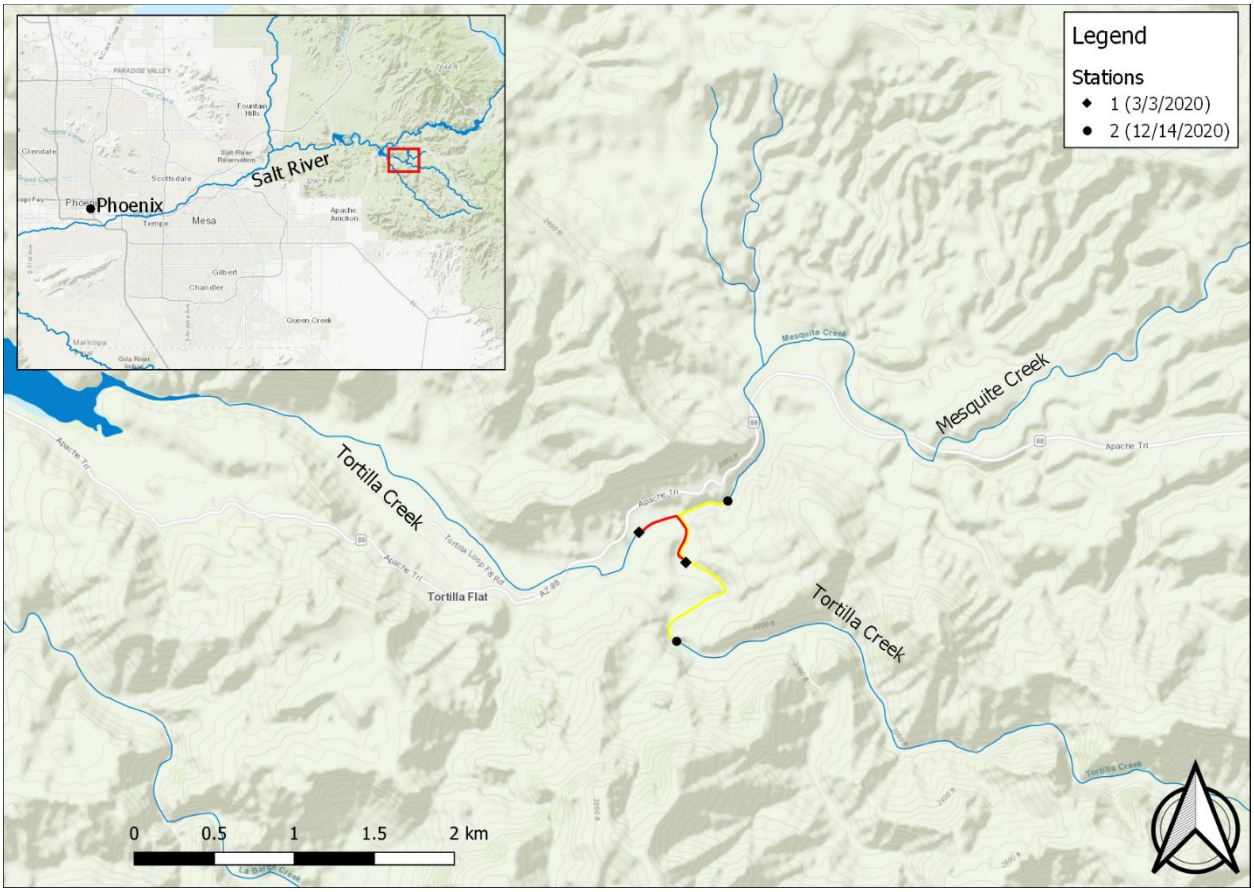

Figure 10. Location of two sampling stations at lower Tortilla Creek, sampled on March 3, 2020 & December 14, 2020.

Figure 11. Example of habitat at Tortilla Creek on March 3, 2020.

Figure 12. Lone pool in Mesquite Creek, sampled on December 14, 2020.

La Barge Creek March 4, 2020 & December 13, 2020

12S NAD83	Lower boundary 1: 461228E, 3709398N	Upper boundary 1: 461638E, 3709078N
	Lower boundary 2: 462558E, 3707942N	Upper boundary 2: 462605E, 3707842N
	Lower boundary 3: 463602E, 3706022N	Upper boundary 3: 463689E, 3706034N

La Barge Creek (Maricopa County, AZ) is fed from a spring in the Superstition Mountains and is tributary to Canyon Lake (Figure 13). Most of La Barge Creek is intermittent, but a perennial section of stream consisting of three to four large pools is located near Battleship Mountain in a slick rock canyon known as "The Box." Gila Topminnow were first confirmed in La Barge Creek in 2015 by AZGFD, but unidentified fish were reported in the drainage as early as 2001. These fish likely originated upstream from Charlebois Spring, where Gila Topminnow were stocked in 1983 (Jones et al 2016). In 2017, the GRBMP established a 100 m station in "The Box" where 364 Gila Topminnow were captured.

On March 4, 2020, La Barge Creek was accessed via the Boulder Canyon trail. Minnow traps and dip net sweeps were used targeting Gila Topminnow at two locations. Gila Topminnow were detected shortly after dropping into the most downstream portion of the canyon and six minnow traps were set in deep pools for six hours (Figure 18). The minnow traps captured a total of 6 Gila Topminnow and 1 Green Sunfish (Table 8). Dip net sweeps were more effective with 29 sweeps capturing 15 Gila Topminnow (Table 7). Topminnow density appeared to be low and the effort was spread out over 500 meters. Flowing water was continuous from Canyon Lake onwards and Gila Topminnow were observed in low densities (<25/100 m) throughout the canyon.

The second station was attempted just downstream of where the trail crosses the creek (Figure 19). Gila Topminnow appeared more abundant throughout this station and 8 traps were set throughout 100 meters of stream for 1.5 hours. Three Gila Topminnow were captured in minnow traps (Table 10). Dip net sweeps were once again more effective, as most fish were observed in the shallow, vegetated margins of the stream. A total of 22 dip net sweeps resulted in the capture of 61 Gila Topminnow in the 100-meter station (Table 9). No other species were captured or observed.

On December 13, 2020, La Barge Creek was revisited to survey the previously established station near Battleship Mountain. This station was extended to 130 m to include the most downstream pool. We observed numerous dead Gila Topminnow in the shallowest portions of the downstream pool and set four, Gee-style minnow traps for two hours. No live fish were detected in this pool. At the upstream pool, thousands of Gila Topminnow were observed; we set four traps in this pool and a total of 2,240 Gila Topminnow were captured. La Barge Creek was dry in between these two isolated pools. Photographs of the upper and lower extent of the station are provided below (Figures 14-17). Water temperature and conductivity were recorded at 9°C and 250 µS, respectively. Another pool was present approximately 80 meters upstream from the end of the station. Two traps were set in this pool and an additional 43 Gila Topminnow were captured.

It is promising to see that, even in a severe drought year, the perennial pools near Battleship Mountain can still support a large number of Gila Topminnow. Connectivity in the spring allowed for the dispersal of Gila Topminnow downstream almost all the way to Canyon Lake. Though, it is unlikely that the non-

native fishes present near the confluence with Canyon Lake would be able to travel the distance upstream to the perennial water in "The Box."

Table 7. Summary of catch at station #1 in La Barge Creek by 1 m dip net sweeps. Total effort was 29 sweeps.

Species	Age	Count	% of total catch	CPUE (fish/net sweep)
POOC	N/A	15	100.00%	0.52
Total		**15**	100.00%	0.52

Table 8. Summary of catch at station #1 in La Barge Creek by minnow trap. Total effort was 36 hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
POOC	N/A	6	85.71%	0.17
LECY	N/A	1	14.29%	0.03
Total		**7**	100.00%	0.19

Table 9. Summary of catch at station #2 in La Barge Creek by 1 m dip net sweeps. Total effort was 22 sweeps.

Species	Age	Count	% of total catch	CPUE (fish/net sweep)
POOC	N/A	60	100.00%	1.28
Total		**60**	100.00%	7.5

Table 10. Summary of catch at station #2 in La Barge Creek by minnow trap. Total effort was 12.667 hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
POOC	N/A	3	100.00%	0.24
Total		**3**	100.00%	0.24

Table 11. Summary of catch at station #3 in La Barge Creek near Battleship Mountain by minnow trap. Total effort was 16.667 hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
POOC	N/A	2,240	100.00%	47.68
Total		**2,240**	100.00%	47.68

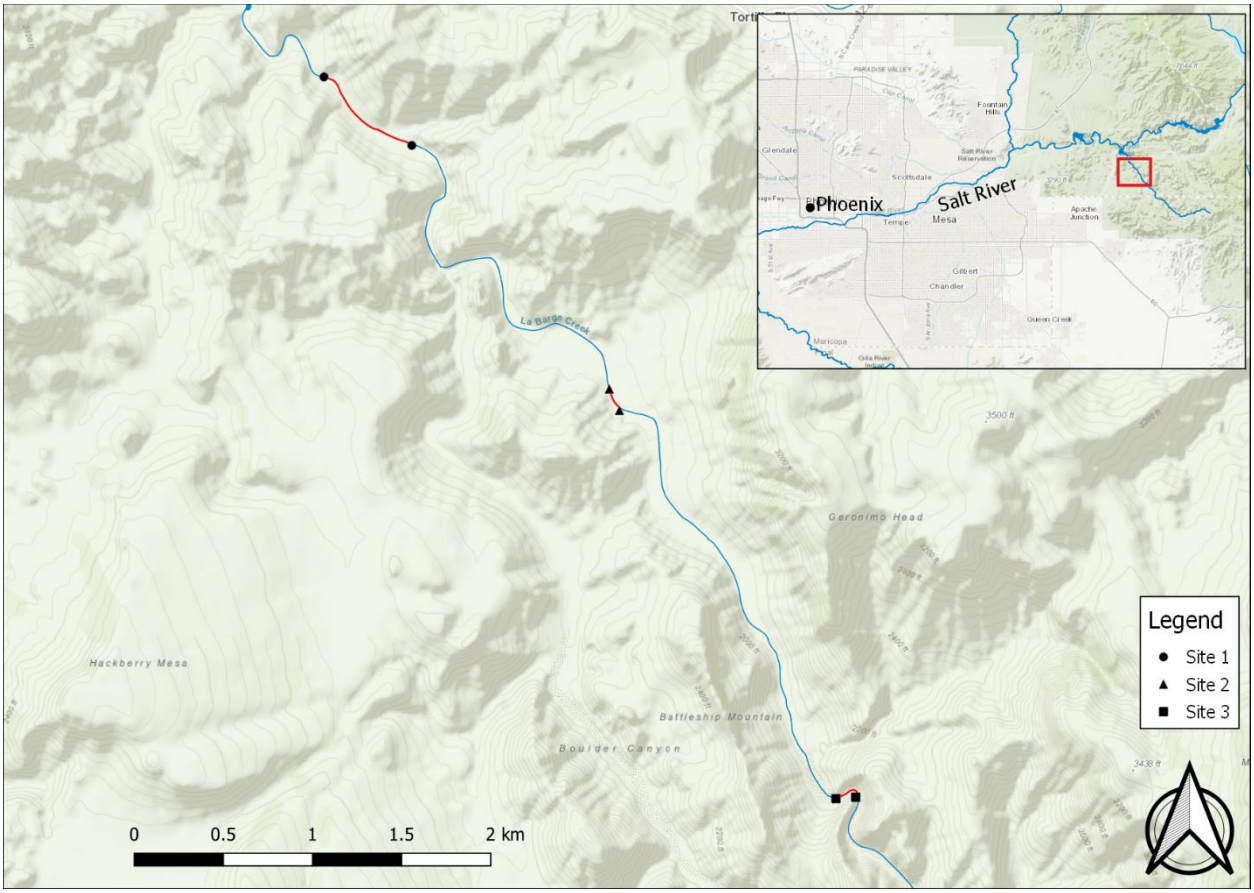

Figure 13. Location of three sampling stations in La Barge Creek, stations 1 & 2 sampled on March 4, 2020 and station 3 sampled on December 13, 2020.

Figure 14. Upstream to downstream view of sampling station #3 at La Barge Creek, sampled December 13, 2020.

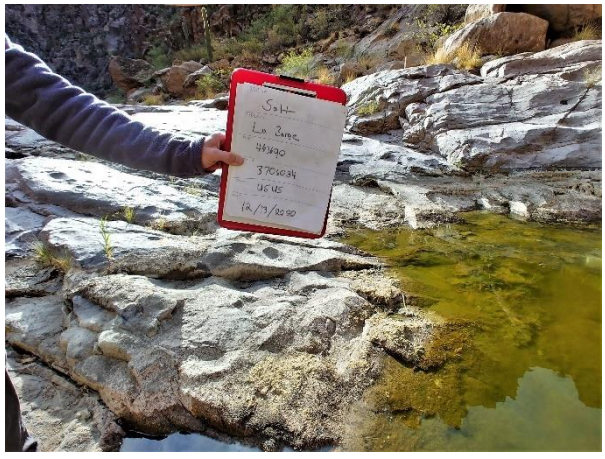

Figure 15. Upstream to upstream view of sampling station #3 at La Barge Creek, sampled December 13, 2020.

Figure 16. Downstream to downstream view of sampling station #3 at La Barge Creek, sampled December 13, 2020.

Figure 17. Downstream to upstream view of sampling station #3 at La Barge Creek, sampled December 13, 2020.

Figure 18. Example of habitat at station #1 at La Barge Creek, sampled March 4, 2020.

Figure 19. Example of habitat at station #2 at La Barge Creek, sampled March 4, 2020.

San Pedro River Basin

Wildcat Canyon September 15, 2020

12S NAD83 Lower boundary: 569817E, 3580701N Upper boundary: 569913E, 3580797N

Wildcat Canyon (Cochise County, AZ) is located within the Muleshoe Ranch Cooperative Management Area and is tributary to Hot Springs Canyon in the San Pedro drainage (Figure 20). There is about 1.4 km of perennial habitat present in Wildcat Canyon. Gila Topminnow were stocked in 2014 (Bylas Spring lineage) into Wildcat Canyon above a large waterfall approximately 900 m upstream of its confluence with Hot Springs Canyon and have persisted there ever since (Gray 2018). Wildcat Canyon has not been surveyed previously under the GRBMP.

On September 15, 2020, Wildcat Canyon was accessed by hiking from Hot Springs Canyon. Minnow traps were determined to be the most effective method of capture at this station as most available habitat consisted of deep pools. A 100 m station was established beginning at the base of the large waterfall where Gila Topminnow originally were stocked. A total of 10 minnow traps were set throughout the station. Traps were set overnight for 16 hours. A total of 735 Gila Topminnow were captured (Table 12), with over half of the individuals (456) coming from two traps set in the large pool below the falls. No other species were captured or observed. Water temperature and conductivity were recorded at 21°C and 740 µS, respectively. Photographs of the upper and lower extent of the station are provided below (Figures 21-24).

This population is protected from upstream movement of non-native fishes by natural waterfalls in the drainage as well as a constructed fish barrier located in lower Hot Springs Canyon. Severe flooding would be the biggest threats to the persistence of Gila Topminnow in Wildcat Canyon due to the narrow nature of this canyon.

Table 12. Summary of catch in Wildcat Canyon by minnow trap. Total effort was 181 net hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
POOC	N/A	737	100.00%	4.07
Total		**737**	**100.00%**	4.07

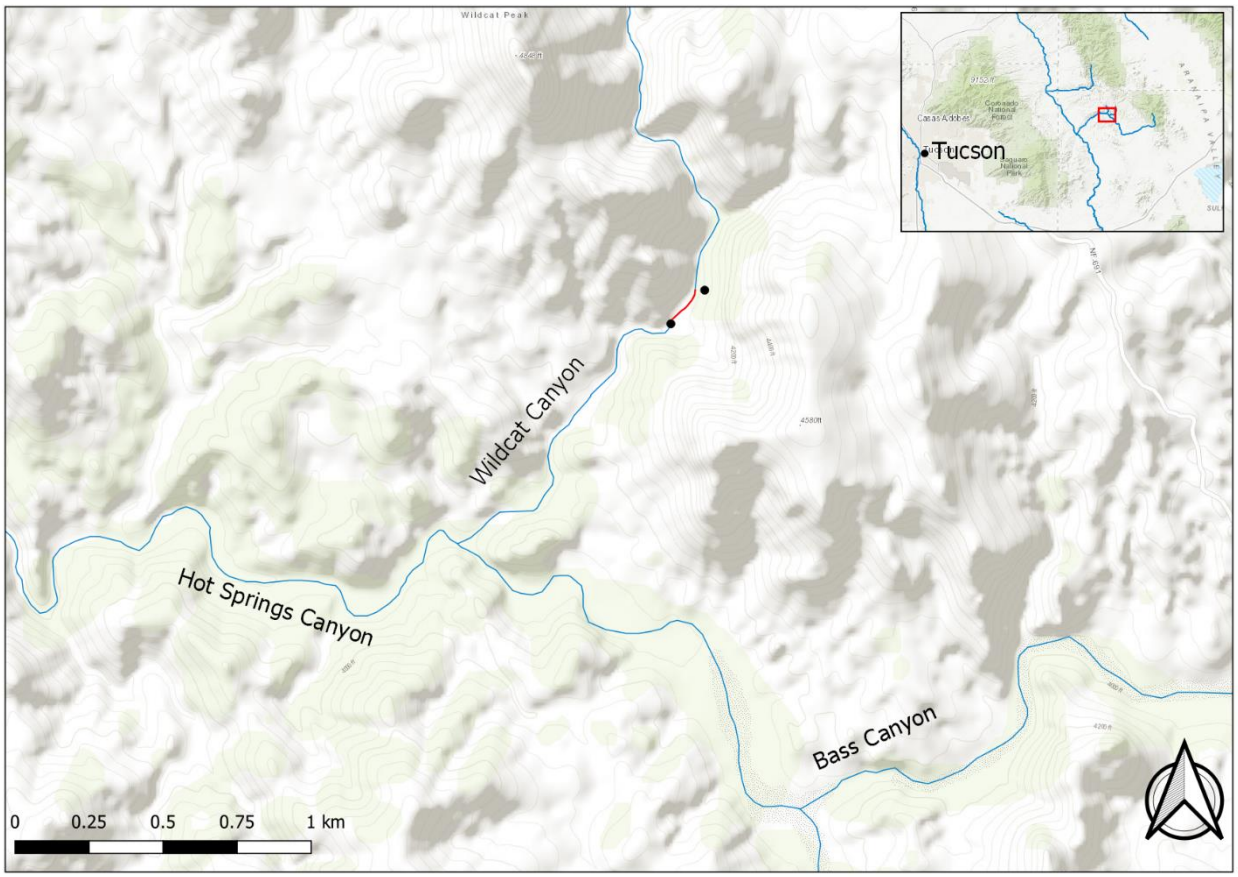

Figure 20. Location of 100 m sampling station at Wildcat Canyon, sampled September 15, 2020.

Figure 21. Downstream to downstream view of 100 m station at Wildcat Canyon.

Figure 22. Downstream to upstream view of 100 m station at Wildcat Canyon.

Figure 23. Upstream to downstream stream view of 100 m station at Wildcat Canyon.

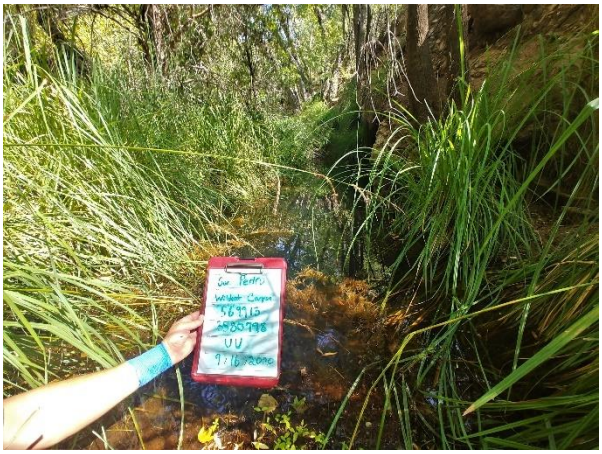

Figure 24. Upstream to upstream stream view of 100 m station at Wildcat Canyon.

Hot Springs Canyon September 14-16, 2020

Reach	Station		Lower Boundary	Upper Boundary
1	EF2	12S NAD 83	569728E, 3579827N	569825E, 3579865N
1	EF5		569524E, 3579983N	569584E, 3579921N
1	EF6 (Fixed)		569434E, 3579940N	569524E, 3579983N
2	EF19		568220E, 3580081N	568587E, 3579966N
2	EF24		568235E, 3580082N	568328E, 3580080N
2	EF26 (Fixed)		568096E, 3580079N	568205E, 3580083N
3	EF30		567997E, 3579896N	568060E, 3579930N
3	EF35 (Fixed)		567737E, 3580066N	567799E, 3580143N
3	EF38		567486E, 3580153N	567573E, 3580096N

Hot Springs Canyon (Cochise County, AZ) originates from the western slopes of the Winchester Mountains and is tributary to the San Pedro River. A 3 km perennial section of stream is located within Muleshoe Ranch Cooperative Management Area. Loach Minnow and Spikedace were stocked into Hot Springs Canyon every year from 2007-2011. Loach Minnow are considered to be established in Hot Springs Canyon as evidence of recruitment has been found every year since the last stocking. It is unclear if Spikedace have established as annual monitoring efforts have noted a steady decrease in numbers since 2012 and recruitment has not been detected every year. This is the first year that the annual monitoring at Hot Springs Canyon is under the GRBMP.

On September 14-16, M&A personnel, with assistance from BOR, completed the sampling at Hot Springs Canyon. Stations were accessed by hiking downstream from the Muleshoe Headquarters. Sampling was completed by backpack electrofishing utilizing the existing monitoring protocols established by the Muleshoe Native Fishes Planning Team. In this protocol, the main perennial section of stream was divided into three distinct reaches and was further divided into 39, 100 m sampling stations, including one "fixed" station in each reach. Two additional stations from each reach were randomly selected for sampling for a total of nine 100 m stations (Figure 25).

Totals of 30 Loach Minnow, 59 Gila Chub, 1,309 Speckled Dace, 773 Longfin Dace, 51 Desert Sucker *Pantosteus clarkii*, and 2 Sonora Sucker *Catostomus insignis* were captured across all nine stations. Catch tables by reach are included below (Tables 13-15). No non-native species were captured or observed. Loach Minnow were detected at 2 of the 9 stations, with 26 individuals coming from the station EF19 in reach 2 (Figure 27). Gila Chub were detected at all 9 stations. No Spikedace were captured.

Surface water was present and continuous throughout reaches 1-3, however generally flows were low. Due to low water, pool and run habitat types were limited and shallow riffle was the dominant mesohabitat at most stations (Figure 26). These conditions likely explain the lower catch numbers for Gila Chub and Sonora Sucker compared to previous monitoring efforts. Loach Minnow numbers are consistent with past surveys and there is evidence of recruitment, with multiple size classes present (Appendix A, Figure A13).

Table 13. Summary of catch for Reach 1 (EF2, EF5, & EF6) at Hot Springs Canyon by BPEF. Total effort was 2,346 seconds.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	312	28.21%	7.98
GIIN	0	14	1.27%	0.36
GIIN	1+	1	0.09%	0.03
PACL	0	9	0.81%	0.23
PACL	1+	3	0.27%	0.08
RHOS	N/A	767	69.35%	19.62
Total		**1106**	100.00%	28.29

Table 14. Summary of catch for Reach 2 (EF19, EF24, & EF26) at Hot Springs Canyon by BPEF. Total effort was 3,021 seconds.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	293	38.15%	5.82
CAIN	1+	2	0.26%	0.04
GIIN	0	11	1.43%	0.22
GIIN	1+	9	1.17%	0.18
PACL	0	17	2.21%	0.34
PACL	1+	8	1.04%	0.16
RHOS	N/A	402	52.34%	7.98
TICO	N/A	26	3.39%	0.52
Total		**768**	100.00%	15.25

Table 15. Summary of catch for Reach 3 (EF30, EF35, & EF38) at Hot Springs Canyon by BPEF. Total effort was 3,021 seconds.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	168	48.00%	5.04
GIIN	0	14	4.00%	0.42
GIIN	1+	10	2.86%	0.3
PACL	0	10	2.86%	0.3
PACL	1+	4	1.14%	0.12
RHOS	N/A	140	40.00%	4.2
TICO	N/A	4	1.14%	0.12
Total		**350**	100.00%	10.5

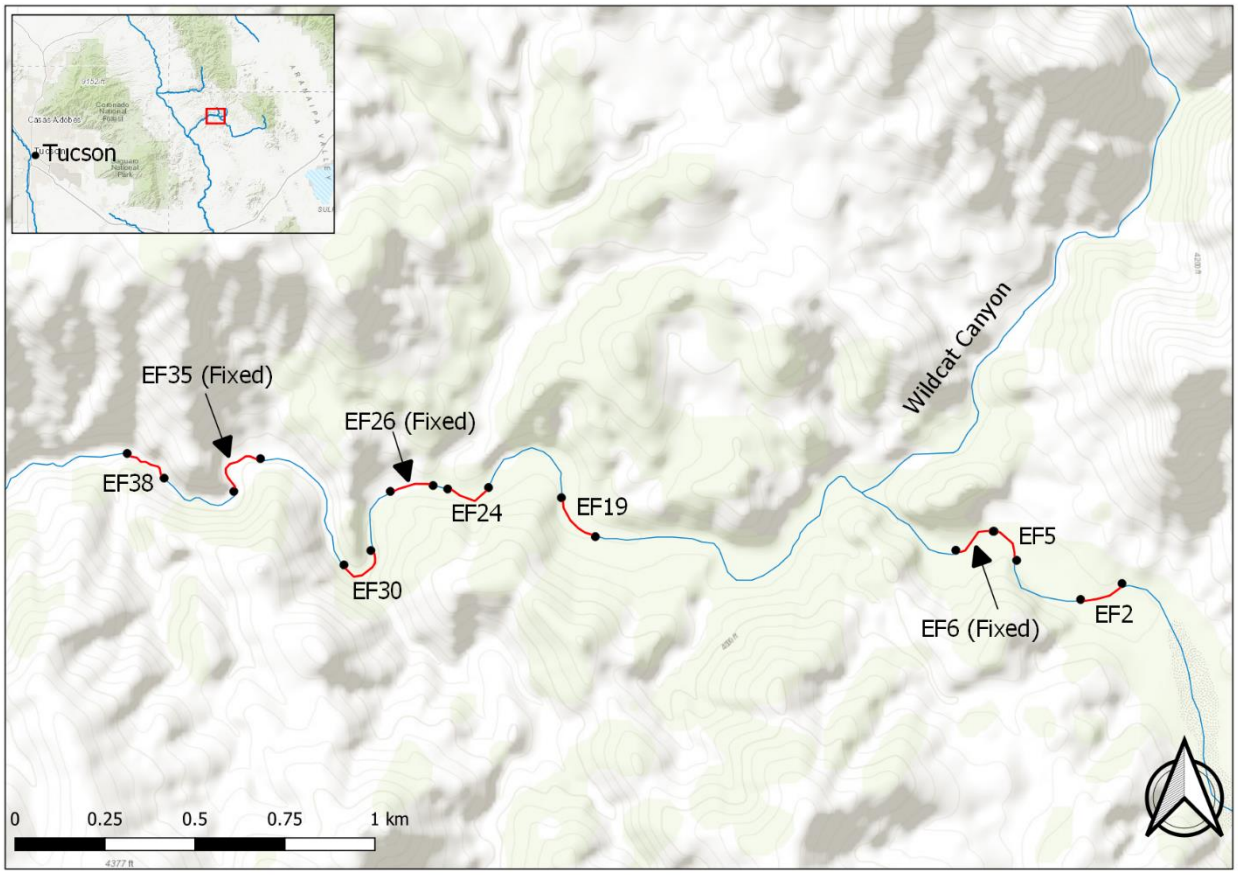

Figure 25. Location of nine, 100 m sampling stations in Hot Springs Canyon, sampled on September 14-16, 2020.

Figure 26. Example of habitat at EF26 in Hot Springs Canyon.

Figure 27. Adult Loach Minnow captured from EF30 in Hot Springs Canyon.

Santa Cruz River Basin

Cottonwood Spring June 9, 2020

12S NAD83 Lower boundary: 528085E, 3502141N Upper boundary: 527556E, 3502061N

Cottonwood Spring (Santa Cruz County, AZ) is tributary to Sonoita Creek located between the towns of Patagonia and Sonoita. The entire length of stream is approximately 100 m before it enters Sonoita Creek, however the majority of the water is diverted into a pipe 60 m downstream of the spring and the remainder flows 40 m in a ditch that empties into Sonoita Creek. A small but stable natural population of Gila Topminnow is present in Cottonwood Spring and sometimes occupies pools in Sonoita Creek when there is habitat available (Weedman 1999). Cottonwood Spring is located on private land. The Partners for Wildlife cooperative management agreement at this site has expired and permission from the landowner now is required to access this site. Cottonwood Spring was last surveyed for the GRBMP in 2014 when 43 Gila Topminnow were captured (Timmons et al. 2015).

On June 9, 2020, M&A and Nature Conservancy personnel sampled Cottonwood Spring. The spring was accessed via a short hike from HWY 82. Fish were collected using dip net sweeps. A total of 192 Gila Topminnow were captured (Table 16). No other species were detected. The 100 m station began at the springhead and ended below the diversion ditch. The majority of fish captured were located in the approximately 60 m long reach between the diversion and the springhead pool. Sampling continued below the diversion for 40 m, which resulted in capture of an additional four individuals. Water was flowing over and around the diversion box and diffusing into adjacent wetland habitat that was too shallow to be sampled effectively. Water temperature and conductivity were recorded at 26.3°C and 1,047µS, respectively. Pictures of the upstream and downstream boundaries of the station can be found below (Figures 29-32).

The small and isolated population at Cottonwood Spring remains stable. This population is protected from non-native fishes by a barrier 1 km downstream in Sonoita Creek. Efforts should be made to restore an agreement with the landowner as the greatest threat to this population would be habitat destruction due to grazing. The expiration of the cooperative agreement means that the maintenance of an exclosure fence around the spring is no longer required. Evidence of grazing was noted at the time of the survey.

Table 16. Summary of catch at Cottonwood Spring by 1 m dip net sweeps. Total effort was 37 sweeps.

Species	Age	Count	% of total catch	CPUE (fish/sweep)
POOC	N/A	192	100	5.19
Total		**192**	**100**	5.19

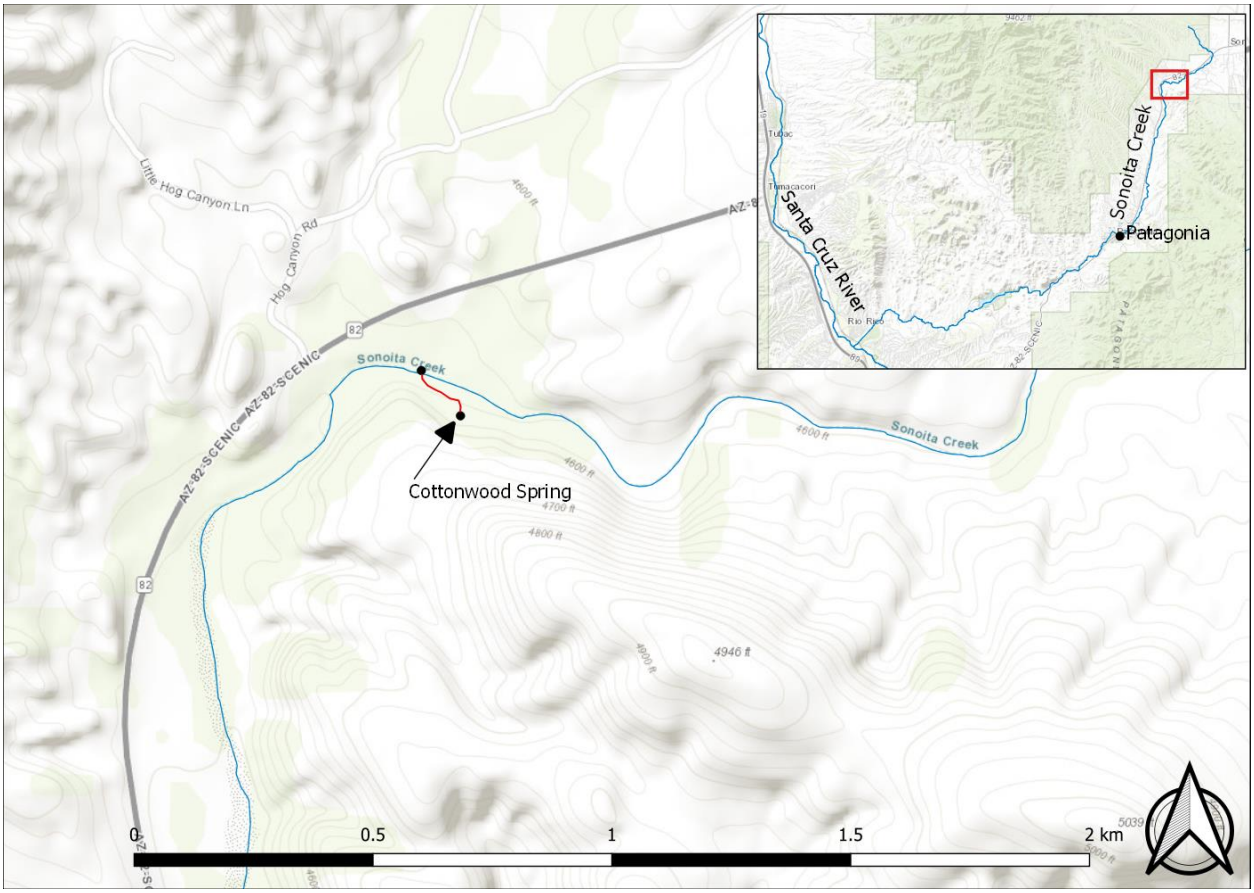

Figure 28. Location of 100 m sampling station at Cottonwood Spring, sampled on June 9, 2020.

Figure 29. Downstream to downstream view of the 100 m sampling site at Cottonwood Spring.

Figure 30. Downstream to upstream view of the 100 m sampling site at Cottonwood Spring.

Figure 31. Upstream to downstream view of 100 m sampling site at Cottonwood Spring.

Figure 32. Upstream to upstream view of 100 m sampling site at Cottonwood Spring.

Parker Canyon June 9, 2020

12R NAD83 Lower boundary: 545346E, 3471072N Upper boundary: 545581E, 3471231N

Parker Canyon (Santa Cruz County, AZ) begins from Parker Canyon Lake and flows south eventually meeting the Santa Cruz River about 2.8 km south of the international border in Mexico (Figure 33). Gila Topminnow were first discovered in Parker Canyon in 2015 in a perennial reach 9 km downstream of Parker Canyon Lake. At the time, non-native fishes such as Green Sunfish, Bluegill, and Western Mosquitofish *Gambusia affinis* also were present. The Gila Topminnow population in Parker Canyon has not been formally monitored and was new to the GRBMP in 2020.

On June 9, 2020, Parker Canyon was accessed immediately upstream of Forest Road 194 at the location where Gila Topminnow originally were detected in 2015. A 280-m stretch of flowing water was sampled with dip net sweeps and seine hauls. A total of 56 dip net sweeps and five seine hauls resulted in the capture of 383 Western Mosquitofish and 21 Longfin Dace (Tables 17-18). No Gila Topminnow were detected after careful examination of each *poeciliid* captured. Water temperature and conductivity were recorded at 27.9°C and 421µS, respectively. Pictures of sampled habitat are provided in Figures 34 & 35.

It is possible that an unknown number of Gila Topminnow still remain in Parker Canyon, however the high abundance of Mosquitofish severely threatens this population. Grazing cattle also were present at the time of this survey. A captive population of Gila Topminnow from Parker Canyon currently is maintained at the ASU animal care facility. A sample from the captive stock clustered genetically with a sample from the Santa Cruz River-Nogales population of Gila topminnow (Mussman et al. 2020).

Table 17. Summary of catch at Parker Canyon by 1 m dip-net sweeps. Total effort was 56 sweeps.

Species	Age	Count	% of total catch	CPUE (fish/sweep)
AGCH	N/A	4	1.34%	0.07
GAAF	N/A	294	98.66%	5.25
Total		**298**	100.00%	5.32

Table 18. Summary of catch at Parker Canyon by straight seine. Total effort was five seine hauls.

Species	Age	Count	% of total catch	CPUE (fish/haul)
AGCH	N/A	17	5.70%	3.4
GAAF	N/A	89	29.87%	17.8
Total		**106**	**100.00%**	21.2

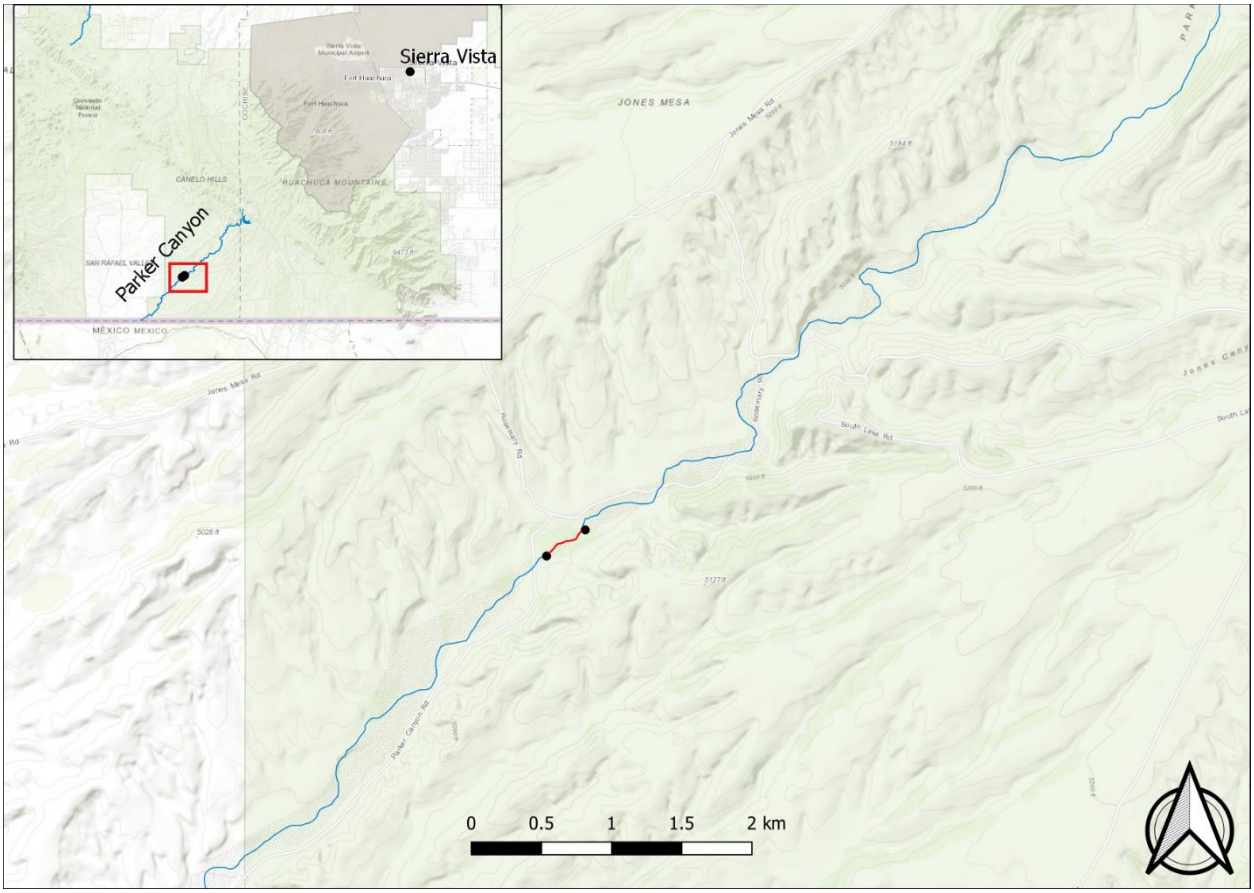

Figure 33. Location of sampling station in Parker Canyon, sampled on June 9, 2020.

Figure 34. Example of available habitat at Parker Canyon, sampled June 9, 2020.

Figure 35. Example of available habitat at Parker Canyon, sampled June 9, 2020.

Upper Gila River Basin

San Francisco River June 3, 2020 & June 16-17, 2020

The San Francisco River is a major tributary to the Gila River and originates in the White Mountains of AZ. It flows east into NM and then turns south, eventually returning west into AZ near Pleasanton, NM. It joins the Gila River near Clifton, AZ. The San Francisco River is largely dominated by non-native fishes, such as Flathead Catfish *Pylodictus olivaris*, Channel Catfish *Ictalurus punctatus*, Red Shiner, and Common Carp *Cyprinus carpio*. However, populations of Loach Minnow and Spikedace are found in the upper San Francisco River in NM. Recent surveys have also detected Roundtail Chub and Spikedace near the Blue River confluence in AZ, suggesting that native fishes are dispersing out of the Blue River and into the San Francisco River. The San Francisco River was a new addition to the GRBMP in 2020. Two separate reaches were targeted for sampling including the Blue River confluence area from White Rock Spring to Martinez Ranch in AZ and the Big Dry Creek confluence area from Sipes Canyon to Frisco Hot Springs in NM.

San Francisco River: White Rock Spring – Martinez Ranch (AZ) June 3, 2020

12S NAD 83	Lower Boundary 1: 667614E, 3675175N	Upper boundary 1: 668146E, 3675352N
	Lower Boundary 2: 668540E, 3675891N	Upper boundary 2: 668991E, 3675986N
	Lower Boundary 3: 669398E, 3675884N	Upper boundary 3: 669807E, 3675592N
	Lower Boundary 4: 670282E, 3675567N	Upper boundary 4: 670585E, 3675715N

Marsh & Associates personnel completed the sampling of San Francisco River (Greenlee County, AZ) between White Rock Spring and Martinez Ranch on June 3, 2020. A BPEF was used to sample four, 500 m stations targeting Loach Minnow and Spikedace. All stations were accessed by hiking downstream from the Dix Creek confluence. A high clearance 4x4 vehicle is necessary to traverse the Martinez Ranch Road. These stations were pre-selected based on the locations of AZGFD fixed monitoring stations.

The first and most downstream station was located approximately 1.5 km downstream of the Blue River confluence. This station was sampled by BPEF for 1,936 seconds. Native species captured were Spikedace (n=13; 9.7%), Longfin Dace (n=79; 59.0%), Desert Sucker (n=6; 4.5%), Roundtail Chub (n=6; 4.5%), and Sonora Sucker (n=3; 2.2%). Non-native species captured were Red Shiner (n=26; 19.4%), Flathead Catfish (n=4; 3.0%), and Channel Catfish (n=3; 2.2%). The primary mesohabitat throughout this station was swift riffles. An example of targeted habitat is provided in Figure 37. Water temperature and conductivity were recorded at 25°C and 622µS, respectively.

The second station began immediately downstream of the Blue River confluence. This station was sampled by BPEF for 1,062 seconds. Spikedace were observed visually in the Blue River just upstream of the confluence, however no Spikedace were detected during the survey at this station. Native species captured were Longfin Dace (n=52; 65.8%), Roundtail Chub (n=5; 6.3%), and Sonora Sucker (n=2; 2.5%). Non-native species captured were Red Shiner (n=12; 15.2%), Channel Catfish (n=5; 6.3%), and Flathead Catfish (n=3; 3.8%). Water temperature and conductivity were recorded at 27.1°C and 614µS, respectively. Mesohabitats consisted of an equal mix of swift riffles, runs, and deep pools. An example of targeted habitat is provided in Figure 38.

The third station was located approximately 1 km upstream of the Blue River confluence. This station was sampled by BPEF for 855 seconds. Native species captured were Spikedace (n=2; 5.4%) and Longfin Dace (n=11; 29.7%). Non-native species captured were Red Shiner (n=9; 24.3%) and Fathead Minnow (n=1; 2.7%). Fishes were sparse and the primary mesohabitat throughout this 500 m station was slow moving, sandy runs (Figure 39). Water temperature and conductivity were recorded at 29.5°C and 615µS, respectively.

The fourth and most upstream station was located approximately 1 km further upstream from station #3 and was sampled by BPEF for 870 seconds. Native species captured were Spikedace (n=1; 2.7%), Longfin Dace (n=7; 18.9%), and Roundtail Chub (n=1; 2.7%). Non-native species captured were Red Shiner (n=22; 59.5%), Flathead Catfish (n=5; 13.5%), and Fathead Minnow (n=1; 2.7%). Aside from a short riffle section at the beginning of the station, the primary mesohabitat here was also long sandy runs which resulted in few fish (Figure 40). Water temperature and conductivity were recorded at 31.5°C and 602µS, respectively.

Catch and effort summaries for all stations are below (Tables 19-22). Northern Crayfish (*Orconectes virilis)* also were observed throughout this reach. Water clarity was high which led to good visibility and effective sampling. Spikedace were captured in low numbers at three of the four stations, and although not targeted, Roundtail Chub also were found at three of four stations indicating that these species are successfully dispersing out of the Blue River. However, the abundance of non-native predacious fishes likely limits the ability of these native species to establish self-sustaining populations in this reach. Loach Minnow were not detected at any station.

Table 19. Summary of catch at station #1 in San Francisco River (AZ) by BPEF. Total effort was 1,936 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	79	58.96%	2.45
CAIN	0	2	1.49%	0.06
CAIN	1+	1	0.75%	0.03
CYLU	N/A	26	19.40%	0.81
ICPU	0	3	2.24%	0.09
MEFU	N/A	13	9.70%	0.4
PACL	0	6	4.48%	0.19
PYOL	0	3	2.24%	0.09
PYOL	1+	1	0.75%	0.03
Total		**134**	**100.00%**	**4.15**

Table 20. Summary of catch at station #2 in San Francisco River (AZ) at Blue River confluence by BPEF. Total effort was 1,062 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	52	65.82%	2.94
CAIN	0	2	2.53%	0.11
CYLU	N/A	12	15.19%	0.68

GIRO	0	5	6.33%	0.28
ICPU	0	3	3.80%	0.17
ICPU	1+	2	2.53%	0.11
PYOL	0	1	1.27%	0.06
PYOL	1+	2	2.53%	0.11
Total		**79**	**100.00%**	**4.46**

Table 21. Summary of catch at station #3 in San Francisco River (AZ) by BPEF. Total effort was 855 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	11	29.73%	0.77
CYLU	N/A	9	24.32%	0.63
MEFU	N/A	2	5.41%	0.14
PIPR	N/A	1	2.70%	0.07
Total		**23**	**62.16%**	**1.61**

Table 22. Summary of catch at station #4 in San Francisco River (AZ) by BPEF. Total effort was 870 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	7	18.92%	0.48
CYLU	N/A	22	59.46%	1.52
GIRO	0	1	2.70%	0.07
MEFU	N/A	1	2.70%	0.07
PIPR	N/A	1	2.70%	0.07
PYOL	0	4	10.81%	0.28
PYOL	1+	1	2.70%	0.07
Total		**37**	**100.00%**	**2.55**

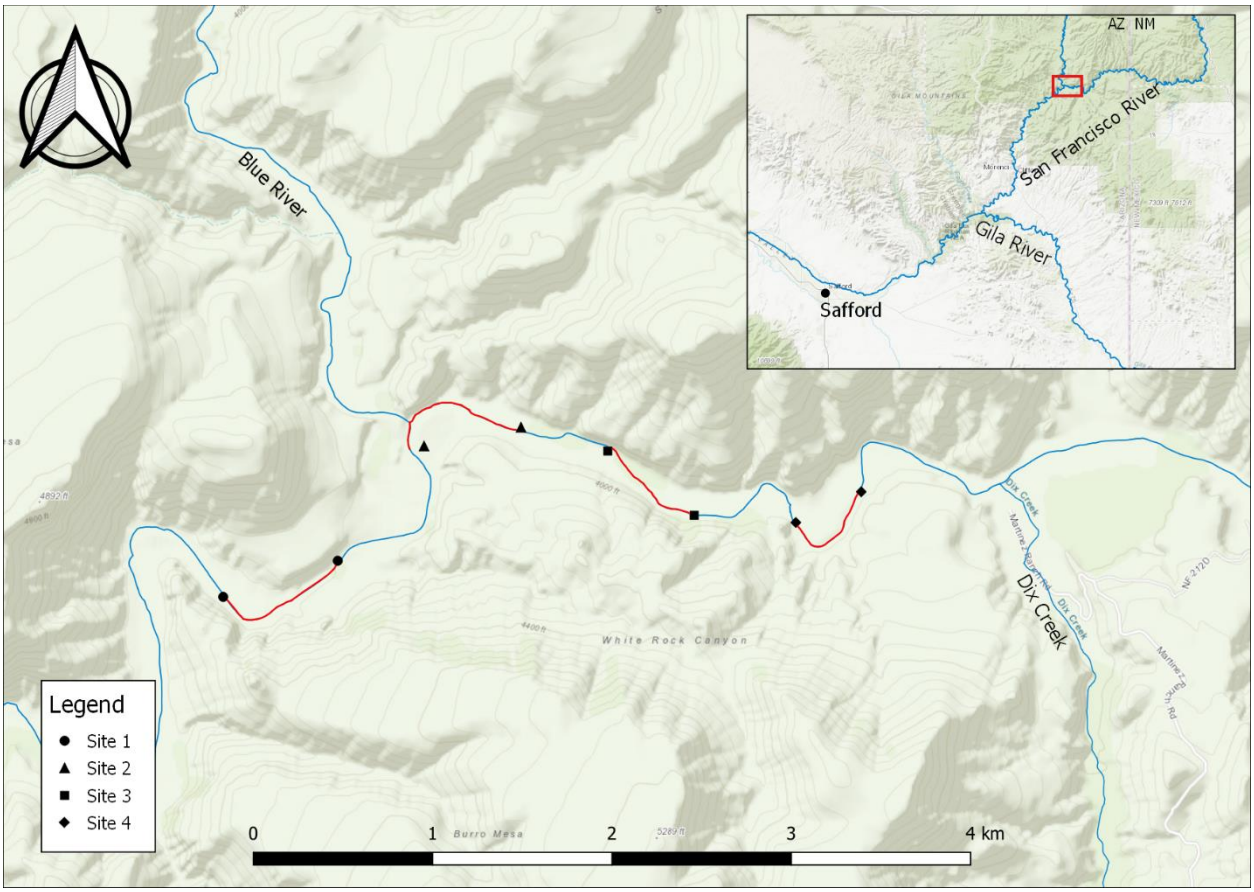

Figure 36. Locations of four sampling stations in San Francisco River (AZ), sampled on June 3, 2020.

Figure 37. Example of habitat at Station #1 in San Francisco River (AZ), sampled on June 3, 2020.

Figure 38. Example of habitat at Station #2 in San Francisco River (AZ), sampled on June 3, 2020.

Figure 39. Example of habitat at Station #3 in San Francisco River (AZ), sampled on June 3, 2020.

Figure 40. Example of habitat at Station #4 in San Francisco River (AZ), sampled on June 3, 2020.

San Francisco River: Sipes Canyon – Frisco Hot Springs (NM) June 16-17, 2020

12S NAD 83	Lower boundary 1: 696400E, 3677539N	Upper boundary 1: 696663E, 3677908N
	Lower boundary 2: 693208E, 3677535N	Upper boundary 2: 693507E, 3677495N
	Lower boundary 3: 697541E, 3679725N	Upper boundary 3: 697418E, 3680225N

Marsh & Associates personnel completed the sampling of San Francisco River (Catron County, NM) on June 16 & 17, 2020. BPEF was used to sample three, 500 m stations targeting Loach Minnow and Spikedace. All stations were accessed by hiking from the Big Dry Creek confluence. A high clearance 4x4 vehicle is necessary to access the Big Dry Confluence area.

The first and most downstream station was located near Sipes Canyon, approximately 5 km downstream of Big Dry Creek. This station was sampled by BPEF for 1,259 seconds. Native species captured were Spikedace (n=1; 0.8%), Longfin Dace (n=86; 69.9%), and Speckled Dace (n=19; 15.5%), Sonora Sucker (n=3; 2.4%). Non-native species captured were Red Shiner (n=8; 6.5%), Western Mosquitofish (n=1; 0.8%), Common Carp (n=3; 2.4%), and Flathead Catfish (n=2; 1.6%). Water temperature and conductivity were recorded at 27°C and 575µS, respectively. A photo of targeted habitat is provided in Figure 42.

The second station began immediately downstream of the Big Dry confluence. This station was sampled by BPEF for 904 seconds. Neither focal species were detected at this station. Native species captured were Longfin Dace (n=27; 40.9%), Speckled Dace (n=18; 27.3%), Sonora Sucker (n=9; 13.6%), and Desert Sucker (n=1; 1.5%). Non-native species captured were Red Shiner (n=9; 13.6%) and Flathead Catfish (n=2; 3.0%). Water temperature and conductivity were recorded at 24°C and 295µS, respectively. A photo of targeted habitat is provided in Figure 43.

The third and most upstream station was located near Frisco Hot Springs, approximately 3.0 km upstream of Big Dry Creek. This station was sampled by BPEF for 1,549 seconds. Native species captured were Spikedace (n=6; 4.8%), Loach Minnow (n=5; 4.0%), Longfin Dace (n=70; 56.0%), Speckled Dace (n=11; 8.8%), Desert Sucker (n=9; 7.2%), and *Gila* sp. (n=1; 0.8). Non-native species captured were Red Shiner (n=16; 12.8%), Channel Catfish (n=4; 3.2%), Flathead Catfish (n=1; 0.8%), Common Carp (n=1; 0.8%), and Largemouth Bass *Micropterus salmoides* (n=1; 0.8). Western Mosquitofish were observed prior to sampling this station but were not captured during the survey. Water temperature and conductivity were recorded at 28°C and 525µS, respectively. A photo of targeted habitat is provided in Figure 44.

Catch and effort summaries for all stations are below (Tables 23-25). The capture of the single *Gila* sp. is the first chub species captured in San Francisco River in NM since 1948 (Paroz & Propst 2007). The nearest established Chub populations are Mule Creek, which is occupied by repatriated Gila Chub from Harden Cienega Creek, and Blue River, which is occupied by Roundtail Chub repatriated from Eagle Creek. A photo of the captured chub is included in Figure 45. Spikedace were captured in low numbers at two of the three stations. Loach Minnow were detected at one station, including young-of-year individuals indicating successful recruitment.

Table 23. Summary of catch at station #1 in San Francisco River (NM) near Sipes Canyon by BPEF. Total effort was 1,259 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	86	69.92%	4.1
CAIN	0	3	2.44%	0.14
CYCA	0	2	1.63%	0.1
CYCA	1+	1	0.81%	0.05
CYLU	N/A	8	6.50%	0.38
GAAF	N/A	1	0.81%	0.05
MEFU	N/A	1	0.81%	0.05
PYOL	1+	2	1.63%	0.1
RHOS	N/A	19	15.45%	0.91
Total		**123**	**100.00%**	**5.86**

Table 24. Summary of catch at station #2 in San Francisco River (NM) at Big Dry Creek confluence by BPEF. Total effort was 904 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	27	40.91%	1.79
CAIN	0	6	9.09%	0.4
CAIN	1+	3	4.55%	0.2
CYLU	N/A	9	13.64%	0.6
PACL	0	1	1.52%	0.07
PYOL	1+	2	3.03%	0.13
RHOS	N/A	18	27.27%	1.2
Total		**66**	**100.00%**	**4.38**

Table 25. Summary of catch at station #3 in San Francisco River (NM) at Big Dry Creek confluence by BPEF. Total effort was 1,549 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	70	56.00%	2.69
CYCA	1+	1	0.80%	0.04
CYLU	N/A	16	12.80%	0.62
Gila sp.	1+	1	0.80%	0.04
ICPU	1+	4	3.20%	0.15
MEFU	N/A	6	4.80%	0.23
MISA	0	1	0.80%	0.04
PACL	0	9	7.20%	0.35
PYOL	1+	1	0.80%	0.04
RHOS	N/A	11	8.80%	0.42
TICO	N/A	5	4.00%	0.19

Total		**125**	100.00%	**4.81**

Table 26. Summary of catch at station #3 in San Francisco River (NM) near Frisco Hot Springs by BPEF. Total effort was 1,549 sec.

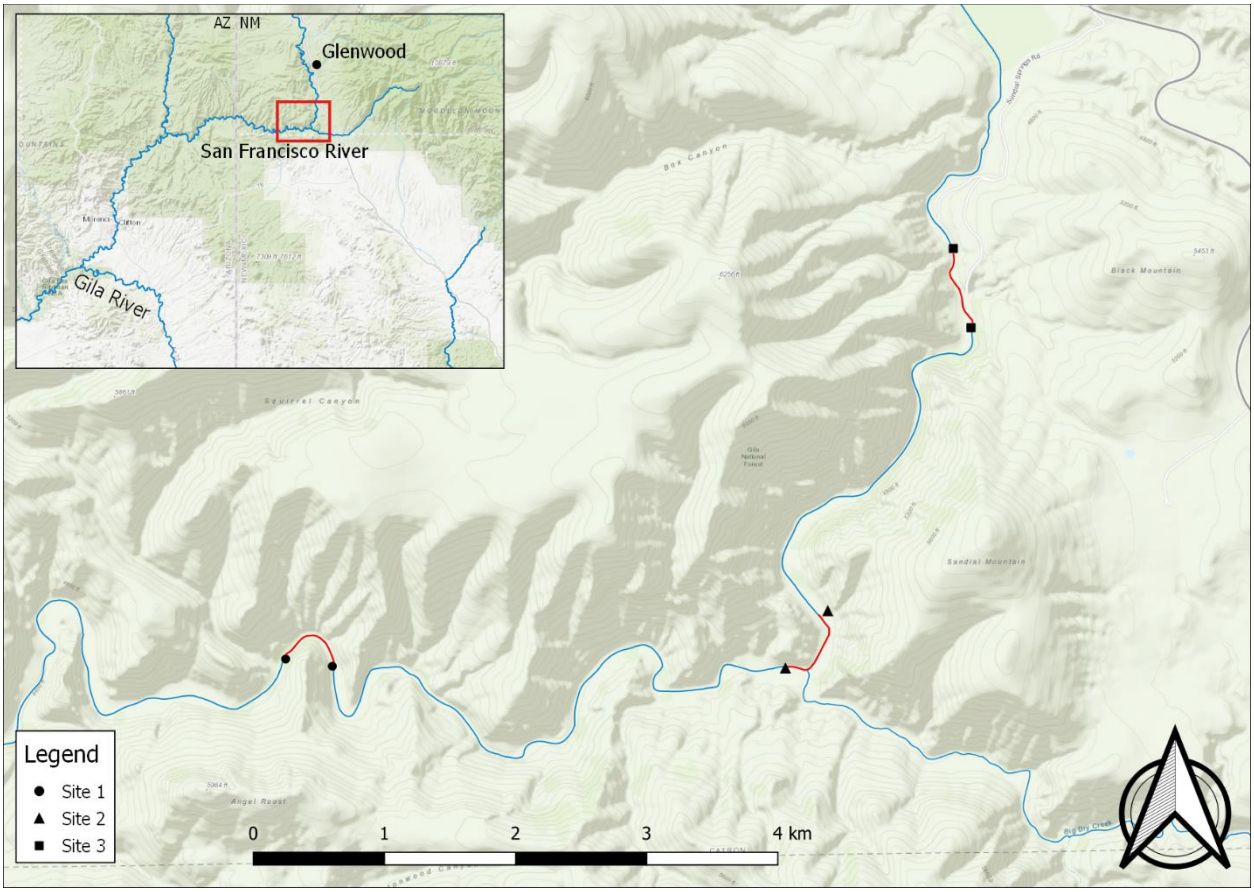

Figure 41. Locations of three sampling stations in San Francisco River (NM), sampled on June 16-17, 2020.

Figure 42. Example of habitat at Station #1 in San Francisco River (NM), sampled on June 17, 2020.

Figure 43. Example of habitat at Station #2 in San Francisco River (NM), sampled on June 17, 2020.

Figure 44. Example of habitat at Station #3 in San Francisco River (NM), sampled on June 16, 2020.

Figure 45. Photo of *Gila* sp. Captured near Frisco Hot Springs, San Francisco River (NM) on June 16, 2020.

Campbell Blue Creek July 7, 2020

12S NAD 83	Lower Boundary 1: 678777E, 3734487N	Upper boundary 1: 678699E, 3734462N
	Lower Boundary 2: 677116E, 3734850N	Upper boundary 2: 676661E, 3734938N
	Lower Boundary 3: 675657E, 3734863N	Upper boundary 3: 675282E, 3734632N

Campbell Blue Creek (Greenlee County, AZ) is located within Apache-Sitgreaves National Forest near Alpine, AZ. It flows southeast and merges with Dry Blue Creek to form the Blue River (Figure 46). The focal species at Campbell Blue Creek is Loach Minnow. Loach Minnow were widely distributed throughout Campbell Blue Creek until 2011 when the Wallow Fire burned 2,115 km2 (522,642 acres) of forest in AZ and fish kills were observed in upper Gila River basin. Immediate post-fire surveys (2011-2012) found Loach Minnow were absent from Campbell Blue Creek (Kesner et al. 2011; Patterson et al. 2012). However, Loach Minnow populations naturally recovered in Campbell Blue Creek three years post-fire and continue to persist (Humphrey et al. 2015; Timmons et al. 2017; Burgad et al. 2019). Campbell Blue Creek was last surveyed for the GRBMP in 2018.

Marsh & Associates personnel completed the sampling of Campbell Blue Creek on July 7, 2020. All sampling was conducted by a combination of BPEF and kick seining at three stations targeting Loach Minnow. All stations were accessed from Luce Ranch Road via Blue River Road.

The first and most downstream station was located upstream of Turkey Creek. We were able to establish a 100 m station because the requisite number of Loach Minnow were captured. Past GRBMP surveys established a station approximately 500 m downstream of this location, however the station was adjusted this year to minimize the impact on recently translocated Loach Minnow stocked near the Turkey Creek confluence. Species captured were Loach Minnow (n=29; 15.0%), Speckled Dace (n=122; 62.9%), Desert Sucker (n=38; 18.7%), and Longfin Dace (n=5; 2.6%). An additional 12 Loach Minnow were captured outside of the 100-meter station. Water temperature and conductivity were recorded at 21°C and 302µS, respectively. Pictures of the upstream and downstream boundaries of the station can be found below (Figures 47-50).

The second station on Campbell Blue Creek was located downstream of KE Canyon. Loach Minnow were immediately detected, and a second 100 m station was attempted. However, fewer than 25 individuals were captured, so sampling continued for a total of 500 m. Species captured were Loach Minnow (n=12; 2.9%), Speckled Dace (n=346; 83.8%), Longfin Dace (n=17; 4.1%), Desert Sucker (n=37; 9.0%), and Brown Trout *Salmo trutta* (n=1; 0.2%). Water temperature and conductivity were recorded at 23°C and 283µS, respectively. A photo of targeted habitat is provided in Figure 51.

The third station on Campbell Blue Creek was located downstream of Cat Creek. This station was sampled for 500 m. Loach Minnow were not detected. Species captured were Speckled Dace (n=213; 94.7%), Desert Sucker (N=8; 3.6%), Sonora Sucker (n=1; 0.4%), and Brown Trout (n=3; 1.3%). Water temperature and conductivity were recorded at 18°C and 280µS, respectively. A photo of targeted habitat is provided in Figure 52.

Catch and effort summaries for all stations are below (Tables 27-29). Loach Minnow were found in higher numbers this year compared to previous surveys (Timmons et al. 2017; Burgad et al. 2019). It should be noted that two weeks prior to this survey AZGFD salvaged fish from the lower Blue River and stocked them into the upper Blue drainage, including 172 Loach Minnow in Campbell Blue Creek near Turkey Creek. Brown Trout catch has been significantly lower since 2016, when a total of 448 individuals were captured across the three stations (Timmons et al. 2017). In 2018, just three individuals

were captured and a total of four individuals were captured this year. A reduced Brown Trout population will further allow for the recovery of Loach Minnow in Campbell Blue Creek.

Table 27. Summary of catch in Campbell Blue Creek (lower station) near Turkey Creek by BPEF. Total effort was 416 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	5	2.58%	0.72
PACL	0	23	11.86%	3.32
PACL	1+	15	7.73%	2.16
RHOS	N/A	122	62.89%	17.6
TICO	N/A	29	14.95%	4.18
Total		**194**	**100.00%**	**27.98**

Table 28. Summary of catch in Campbell Blue Creek (middle station) at KE Canyon by BPEF. Total effort was 847 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	17	4.12%	1.2
PACL	0	32	7.75%	2.27
PACL	1+	5	1.21%	0.35
RHOS	N/A	346	83.78%	24.51
SATR	1+	1	0.24%	0.07
TICO	N/A	12	2.91%	0.85
Total		**413**	**100.00%**	**29.26**

Table 29. Summary of catch in the Campbell Blue Creek (upper station) near Cat Creek by BPEF. Total effort was 625 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
CAIN	0	1	0.44%	0.1
PACL	0	6	2.67%	0.58
PACL	1+	2	0.89%	0.19
RHOS	N/A	213	94.67%	20.45
SATR	0	3	1.33%	0.29
Total		**225**	**100.00%**	**21.6**

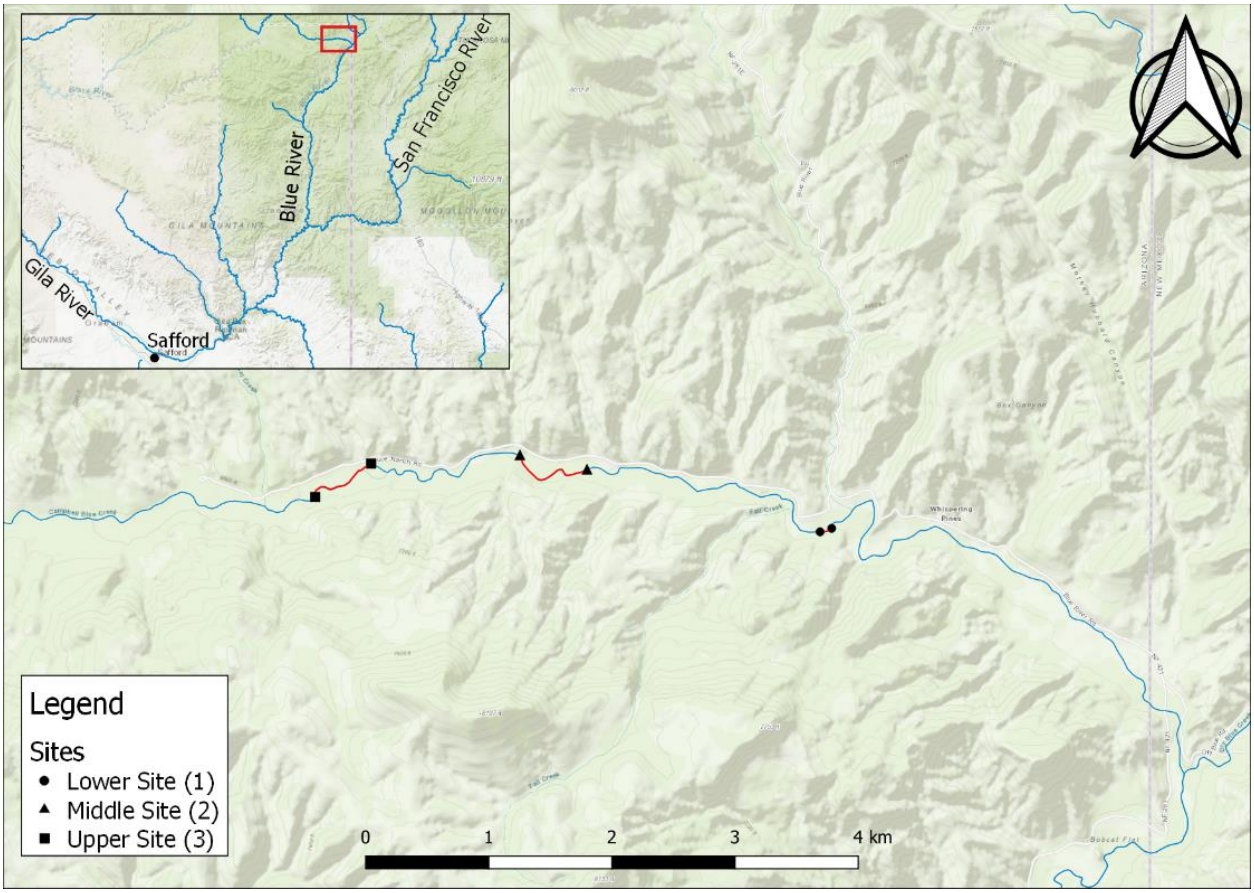

Figure 46. Locations of sampling stations at Campbell Blue Creek, sampled on July 7, 2020.

Figure 47. Downstream to downstream view of 100 m sampling station at Campbell Blue Creek (lower station).

Figure 48. Downstream to upstream view of 100 m sampling station at Campbell Blue Creek (lower station).

Figure 49. Upstream to downstream view of 100 m sampling station at Campbell Blue Creek (lower station).

Figure 50. Upstream to upstream view of 100 m sampling station at Campbell Blue Creek (lower station).

Figure 51. Example of habitat at Campbell Blue Creek near KE Canyon (middle station).

Figure 52. Example of habitat at Campbell Blue Creek near Cat Creek (upper station).

Dry Blue & Pace Creek July 8, 2020

12S NAD 83 Lower Boundary 1: 681870E, 3733846N Upper boundary 1: 682035E, 3734215N

Lower Boundary 2: 683053E, 3736904N Upper boundary 2: 682701E, 3737211N

Dry Blue Creek and Pace Creek (Catron County, NM) both are located in Apache-Sitgreaves National Forest. Pace Creek is tributary to Dry Blue Creek (Figure 53). Dry Blue Creek merges with Campbell Blue Creek to form the Blue River. Both sites were last surveyed for the GRBMP in 2018. The focal species at these sites is Loach Minnow. Loach Minnow were reported before the 2011 Wallow Fire (Bagley et al. 1998, Karam and Kesner 2007) but have not been detected from Dry Blue Creek post-fire (Massure et al. 2013; Humphrey et al. 2015; Timmons et al. 2017; Burgad et al. 2019).

Marsh & Associates personnel completed the sampling of Dry Blue and Pace creeks on July 8, 2020. All sampling was conducted by a combination of BPEF and kick seining.

The station at Dry Blue Creek was located approximately 1.4 km upstream from its confluence with Campbell Blue Creek and was accessed via the Frieborn Canyon Trail. Loach minnow were not detected throughout the 500 m station. Species captured were Speckled Dace (n=228; 92.7%) and Longfin Dace (n=18; 7.3%). Water temperature and conductivity were recorded at 16°C and 418µS, respectively. A photo of targeted habitat is provided in Figure 54.

Pace Creek was surveyed approximately 1 km upstream from its confluence with Dry Blue Creek. Pace Creek was intermittent throughout this station and only about half of the 500 m station had surface water. Loach Minnow were not detected. Species captured were Longfin Dace (n=43; 78.2%) and Speckled Dace (n=12; 21.8%). Water temperature and conductivity were recorded at 19°C and 520µS, respectively. A photo of targeted habitat is provided in Figure 55.

Catch and effort summaries for both stations are below (Tables 30-31). It is unclear why Loach Minnow have recovered in Campbell Blue Creek, but not Dry Blue and Pace Creek. Habitat appeared suitable to Loach Minnow in Dry Blue Creek. Shallow, gravel riffle was the predominant mesohabitat throughout the 500 m station in Dry Blue Creek. Pace Creek had little water at the time of this survey and did not appear suitable for Loach Minnow.

Table 30. Summary of catch in Dry Blue Creek by BPEF. Total effort was 932 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	18	7.32%	1.16
RHOS	N/A	228	92.68%	14.68
Total		**246**	**100.00%**	**15.84**

Table 31. Summary of catch in Pace Creek by BPEF. Total effort was 145 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
AGCH	N/A	43	78.18%	17.79
RHOS	N/A	12	21.82%	4.97
Total		**55**	**100.00%**	**22.76**

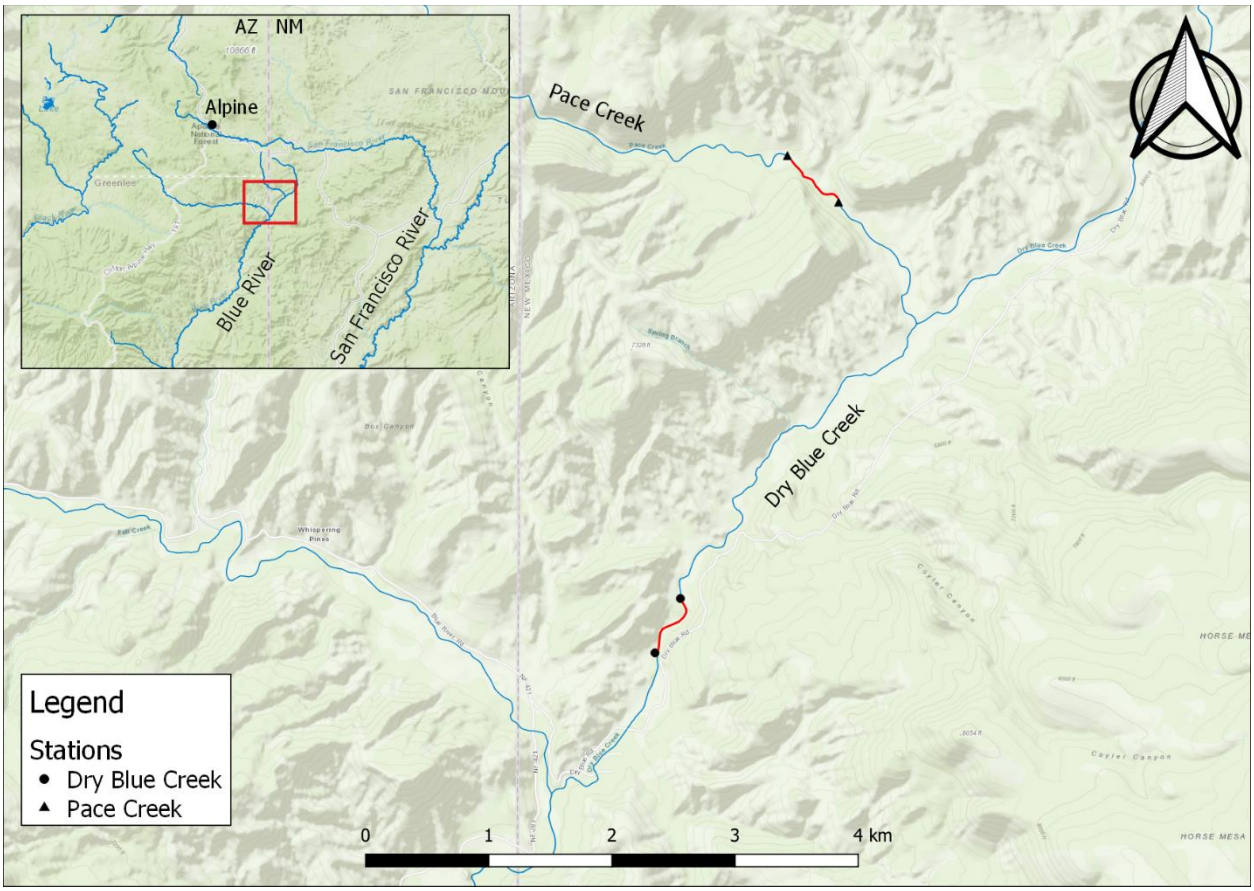

Figure 53. Location of 500 m sampling stations at Dry Blue and Pace Creek, sampled July 8, 2020.

Figure 54. Example of available habitat at Dry Blue Creek, sampled July 8, 2020.

Figure 55. Example of available habitat at Pace Creek, sampled July 8, 2020.

Lower Blue River October 5-8, 2020

Reach	Station		Lower Boundary	Upper Boundary
2	EF32	12S NAD 83	668652E, 3680247N	668553E, 3680411N
2	EF34		668534E, 3680609N	668707E, 3680745N
3	EF42		668008E, 3681456N	667866E, 3681614N
3	EF45		667725E, 3681915N	667794E, 3682097N
4	EF54		668144E, 3683558N	668164E, 3683757N
4	EF55		668164E, 3683757N	668114E, 3683938N
5	EF64 (Fixed)		667972E, 3685054N	668090E, 3685214N
5	EF69		668174E, 3685885N	668194E, 3686042N
5	EF71		668271E, 3686217N	668469E, 3686198N
6	EF76		668389E, 3686613N	668384E, 3686819N
6	EF80		668169E, 3687204N	668203E, 3687379N
6	EF90 (Fixed)		668613E, 3688485N	668626E, 3688689N

The Blue River (Greenlee County, AZ) is a major tributary to the San Francisco River and is located in Apache-Sitgreaves National Forest (Figure 56). The monitoring for the lower Blue River takes place in Reaches 2-6, which is located from Pats Mesa to Fritz Ranch. This is the first year that the lower Blue River annual monitoring is under the GRBMP. Previously, this monitoring was part of the Blue River Native Fish Restoration Project. The major components of that project were construction of a fish barrier, mechanical removal of nonnative fishes, and restoration and monitoring of federally listed fishes in the Blue River. The fish barrier was constructed in 2012 and is located 0.8km from the San Francisco River confluence. Spikedace and Roundtail Chub were stocked into the lower Blue River in 2012 and 2015 and have since established self-sustaining populations (Hickerson and Robinson 2019). Non-natives, such as Green Sunfish, Fathead Minnow, Red Shiner, and Channel Catfish, have not been detected since 2017. The monitoring for this year followed the previously established protocols.

Marsh & Associates personnel completed the annual native fish monitoring for the lower Blue River on October 5-8, 2020. Sampling was completed by backpack electrofishing. Twelve (10 random, 2 fixed), 200 m long stations were electrofished in reaches two through six.

Totals of 642 Spikedace, 645 Loach Minnow, 214 Roundtail Chub, 1,339 Desert Sucker, 661 Speckled Dace, 365 Longfin Dace, and 335 Sonora Sucker were captured (Table 1). No non-native species were captured or observed. Multiple size classes were observed for all species (Appendix A, Figures A14-A16). Anchor worm *Lernaea cyprinacea* parasites were observed on numerous adult Roundtail Chub (Figure 57).

Visibility was poor (< 15 cm) at all stations due to high turbidity. In addition to turbidity, pools and runs were filled with fine sediment and silt (Figures 58-60). In some cases, the sediment was more than knee deep, which made sampling in pools difficult. These two factors likely contributed to the lower than usual Roundtail Chub and Sonora Sucker catch totals. With the exception of the swiftest flowing sections, fine sediment covered the majority of the stream bottom. Photos of habitat at fixed stations EF94 and EF90 are provided in Figures 61-62. Catch totals for species preferring swifter water such as Speckled Dace, Loach Minnow, and Desert Sucker were comparable to previous monitoring efforts.

The increased sediment and high turbidity are likely due to impacts from the Bringham and Cow Canyon fires located further up in the drainage. Ash flows from subsequent storms may be detrimental to the native fish assemblage in the lower Blue River.

Table 32. Summary of catch by BPEF for the 12 stations sampled on the lower Blue River combined by reach.

Reach	Station	Statistic	AGCH	CAIN	GIRO	MEFU	PACL	RHOS	TICO	Totals
2	EF32 EF34	Count	14	108	77	147	350	85	62	843
		% total catch	1.66	12.81	9.13	17.44	41.52	10.08	7.35	100.00
		CPUE (fish/min)	0.19	1.48	1.05	2.01	4.79	1.16	0.85	11.54
3	EF42 EF45	Count	71	37	47	108	254	71	127	715
		% total catch	9.93	5.17	6.57	15.10	35.52	9.93	17.76	100.00
		CPUE (fish/min)	1.37	0.71	0.91	2.08	4.89	1.37	2.45	13.78
4	EF54 EF55	Count	133	69	50	187	306	125	173	1043
		% total catch	12.75	6.62	4.79	17.93	29.34	11.98	16.59	100.00
		CPUE (fish/min)	2.07	1.08	0.78	2.92	4.77	1.95	2.7	16.27
5	EF64 EF69 EF71	Count	80	83	37	123	304	182	188	997
		% total catch	8.02	8.32	3.71	12.34	30.49	18.25	18.86	100.00
		CPUE (fish/min)	0.97	1.0	0.45	1.48	3.67	2.2	2.27	12.03
6	EF76 EF80 EF90	Count	67	38	3	77	130	198	90	603
		% total catch	11.11	6.30	0.50	12.77	21.56	32.84	14.93	100.00
		CPUE (fish/min)	0.93	0.53	0.04	1.07	1.8	2.75	1.25	8.37

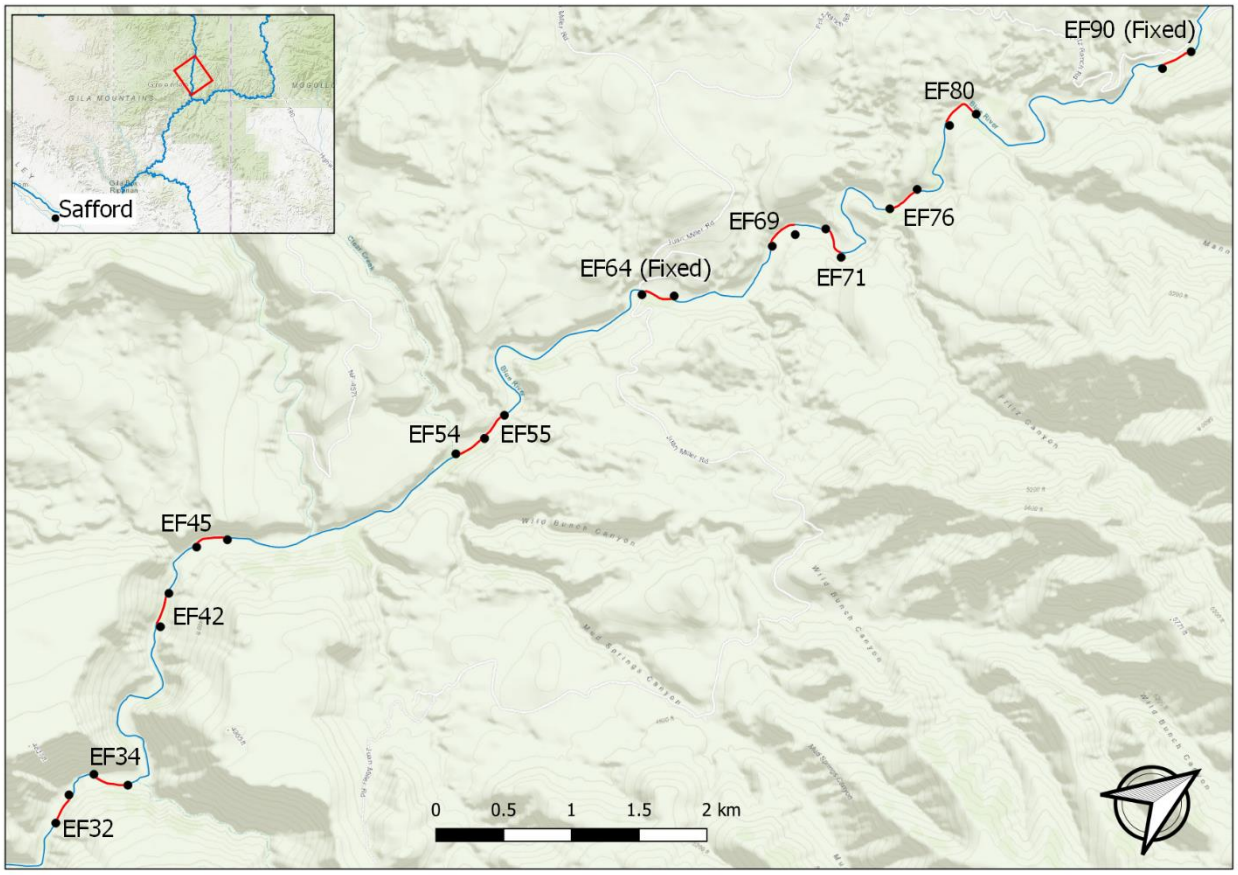

Figure 56. Locations of 12, 200 m sampling stations on the lower Blue River, sampled October 5-8, 2020.

Figure 57. *Lernaea cyprinacea* parasite present on caudal peduncle of a Roundtail Chub in the lower Blue River.

Figure 58. Example of muddy conditions at Blue River, sampled October 5-8, 2020.

Figure 59. Example of poor visibility in pools due to mud and silt at Blue River, sampled October 5-8, 2020.

Figure 60. Example of water clarity at Blue River, sampled October 5-8, 2020.

Figure 61. Example of habitat at Blue River fixed station EF90 on October 5, 2020.

Figure 62. Blue River at Juan Miller Rd crossing (EF64) looking upstream on October 7, 2020.

Verde River Basin

Walker Creek April 22, 2020

12S NAD 83 Lower boundary:436013E, 3833687N Upper boundary: 436118E, 3833699N

Walker Creek (Yavapai County, AZ) is tributary to Wet Beaver Creek and is located in Coconino National Forest in the Verde River basin. The focal species for Walker Creek is Gila Chub. Previous GRBMP surveys established a 100 m station upstream of Rancho Roco Roja. Sufficient numbers (>25) of Gila Chub have been detected during GRBMP surveys in 2014, 2016 and 2018 (Timmons et al. 2015; Timmons et al. 2017; Burgad et al. 2019).

Marsh & Associates personnel completed sampling of Walker Creek on April 22, 2020. The sampling station was accessed by the Walker Basin trail off Forest Road 9201C. A BPEF was used to sample this station.

This 100 m station began at the large pool immediately below the diversion dam. Species captured were Gila Chub (n=26; 15.1%), Speckled Dace (n=141; 82.0%) and Desert Sucker (n=5; 1.9%). No non-natives were captured or observed at this station. Catch and effort data are tabulated in Table 33. Additional Gila Chub were observed in the deeper portions of the pool that we were unable to effectively sample via BPEF shocking. The remainder of the station was comprised mainly of pool and run mesohabitats separated by short, cascading riffles. Water temperature and conductivity were recorded at 16°C and 380µS, respectively. Pictures of the upstream and downstream boundaries of the station can be found below (Figures 47-50).

Additional exploratory sampling was conducted beginning approximately 500 m upstream of the confluence with Wet Beaver Creek at 12S 432877/3834491. Efforts were focused in deeper pools throughout a 750-meter stretch. Green Sunfish and Speckled Dace were the only species identified. No physical barrier appears to exist to prevent the movement of non-native fishes upstream, however intermittent flows seemingly restrict non-native fishes to the lower portion of Walker Creek.

Table 33. Summary of catch in 100 m station at Walker Creek by BPEF. Total effort was 1,519 sec.

Species	Age	Count	% of total catch	CPUE (fish/min)
GIIN	0	10	5.81%	0.4
GIIN	1+	16	9.30%	0.63
PACL	0	3	1.74%	0.12
PACL	1+	2	1.16%	0.08
RHOS	N/A	141	81.98%	5.57
Total		**172**	**100.00%**	6.79

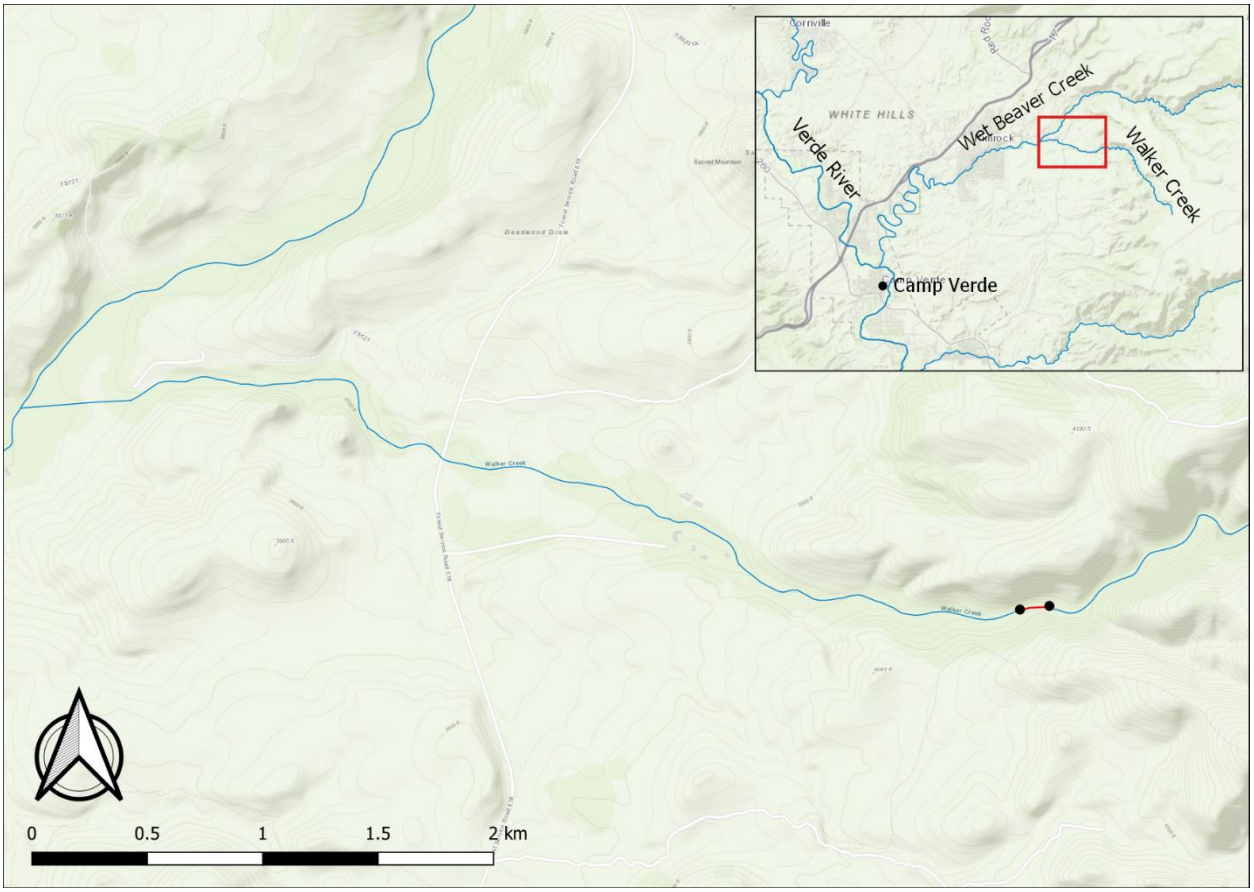

Figure 63. Location of 100 m sampling station in Walker Creek, sampled on April 22, 2020.

Figure 64. Downstream to downstream view of the 100 m sampling site at Walker Creek.

Figure 65. Downstream to upstream view of the 100 m sampling site at Walker Creek.

Figure 66. Upstream to downstream view of the 100 m sampling site at Walker Creek.

Figure 67. Upstream to upstream view of the 100 m sampling site at Walker Creek.

Fossil Creek		May 19-21, 2020
12S NAD 83	Lower boundary 1: 439484E, 3804251N	Upper boundary 1: 439436E, 3804672N
	Lower boundary 2: 439486E, 3805236N	Upper boundary 2: 439954E, 3805494N
	Lower boundary 3: 441699E, 3805907N	Upper boundary 3: 442079E, 3806084N
	Lower boundary 4: 444404E, 3808184N	Upper boundary 4: 442005E, 3805943N

Fossil Creek (Yavapai & Gila cos., AZ) is located within Tonto National Forest and is tributary to the Verde River (Figure 62). Gila Topminnow (Sharp Spring lineage) were stocked into Fossil Creek multiple times between 2007 and 2011 (Gray 2018). Visual counts from snorkel surveys have fluctuated over the years, but Gila Topminnow are considered established in Fossil Creek (Robinson et al. 2017). Gila Topminnow are thought to be distributed from the constructed fish barrier to Fossil Springs, with recent surveys most consistently observing them near the Mazatzal Recreation Area. Fossil Creek has not been previously monitored as part of the GRBMP.

Marsh & Associates personnel completed the sampling of Fossil Creek on May 19-21, 2020. Fossil Creek was sampled via snorkel surveys with the purpose of identifying locations to set minnow traps. All snorkeling was completed in a single pass with three observers.

On May 19, three 500 m stations were snorkeled targeting Gila Topminnow habitat, including slackwater pools, backwaters, and vegetated margins. The three stations were accessed from the Mazatzal, Sally May, and Fossil Creek Bridge parking areas. Gila Topminnow were not observed at any of these three locations. Appropriate habitat was identified downstream of Fossil Creek Bridge and 14 minnow traps were set at 1630 and retrieved at 1720 the next day. These traps captured Roundtail Chub (n=97; 54.5%), Speckled Dace (n=65; 36.5%), Desert Sucker (n=7; 3.9%), and Sonora Sucker (n=9; 5.1%).

On May 20, Fossil Springs was accessed via the Irving Trail and seven traps were set in spring and side channel pools above Fossil Creek Dam. These traps were set at 1100 and retrieved the next day at 1030. Six additional traps were set approximately 200 m downstream of the Fossil Creek Dam (APS diversion dam remnant) in what appeared to be ideal habitat. These traps were set at 1130 and retrieved the next day at 1115. Traps above the dam captured Headwater Chub *Gila nigra* (n=36; 75.0%) and Speckled Dace (n=12; 25.0%). The six traps downstream captured Roundtail Chub (n=48; 46.1%) and Speckled Dace (n=56; 53.9%). Water temperature and conductivity at Fossil Springs were 20°C and 930µS, respectively.

A snorkel survey was then conducted traveling downstream for approximately 4km ending below the "High Falls." Visual surveys were focused in the vegetated margins and backwater habitats. Gila Topminnow were observed approximately 1.5km downstream of Fossil Creek Dam. More than 40 individuals were observed in a 10 m long section of the creek. Fish were located under algal mats located over a shallow shelf, which seemed to provide warmer water. Both males and females were observed. UTM coordinates for this location are 12S 446163/3808943. This was the only location where Gila Topminnow were observed during the surveys. Traps were not set due to the difficulty of accessing this area.

Catch and effort tables for the minnow trap sets are tabulated in Tables 34-36. Gila Topminnow do not appear to be widespread throughout Fossil Creek. It is possible other discrete pockets of Gila Topminnow exist within Fossil Creek where conditions are right. Due to the size of this system, eDNA surveys may be useful in detecting Gila Topminnow in Fossil Creek and to allow for better targeted traditional sampling.

Table 34. Summary of catch by minnow trap at Fossil Creek below bridge. Total effort was 25.33 net hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
GIRO	0	74	41.57%	2.92
GIRO	1+	23	12.92%	0.91
RHOS	N/A	65	36.52%	2.57
PACL	0	7	3.93%	0.28
CAIN	0	9	5.06%	0.36
Total		**178**	100.00%	7.03

Table 35. Summary of catch by minnow trap at Fossil Creek below Fossil Creek Dam. Total effort was 23.75 net hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
GIRO	0	42	40.38%	1.77
GIRO	1+	6	5.77%	0.25
RHOS	N/A	56	53.85%	2.36
Total		**104**	100.00%	4.38

Table 36. Summary of catch by minnow trap at Fossil Creek upstream of Fossil Creek Dam. Total effort was 23.5 net hours.

Species	Age	Count	% of total catch	CPUE (fish/net hr)
GINI	0	27	56.25%	1.15
GINI	1+	9	18.75%	0.38
RHOS	N/A	12	25.00%	0.51
Total		**48**	100.00%	2.04

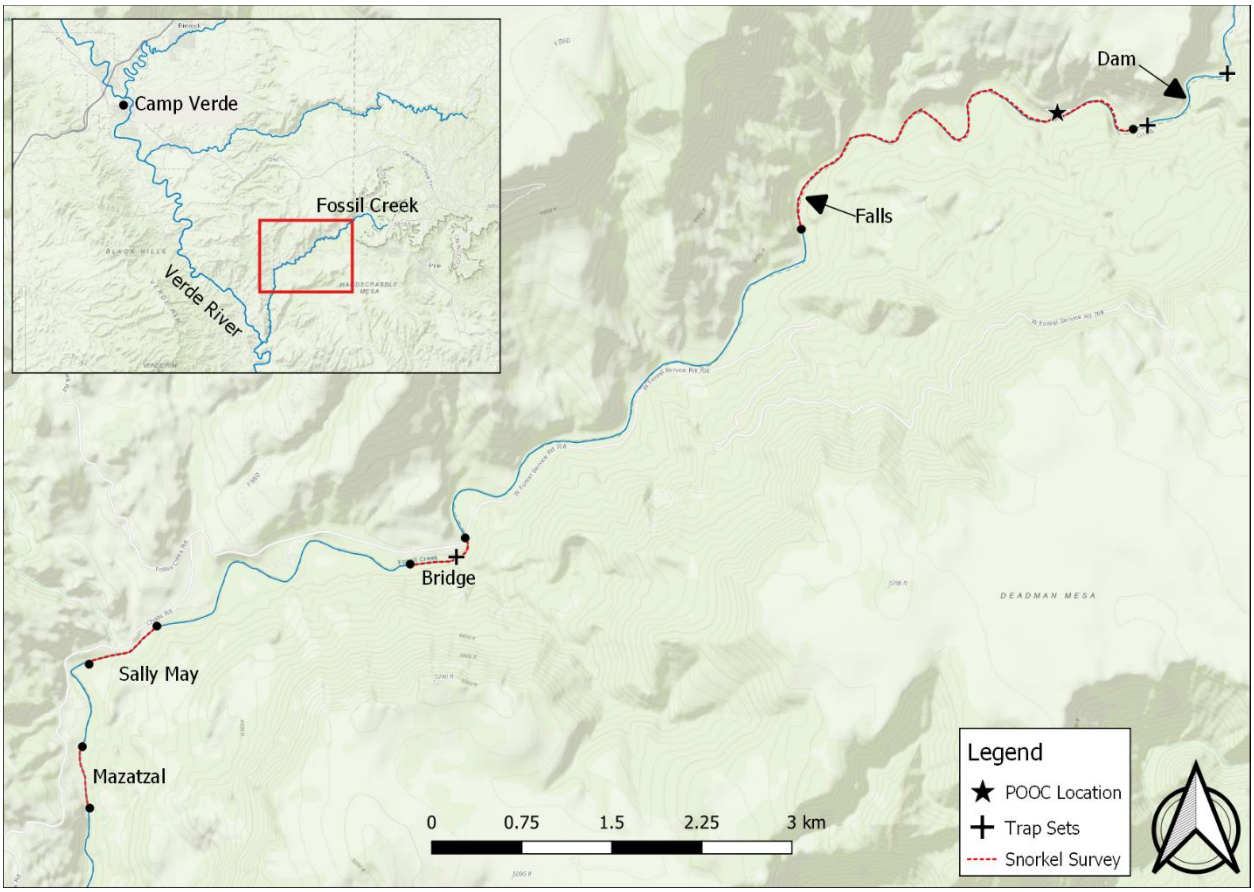

Figure 68. Location of snorkel surveys, minnow trap sets, and observed Gila Topminnow in Fossil Creek, surveyed May 19-21, 2020.

Figure 69. Example of habitat near Mazatzal Recreation Area in Fossil Creek, surveyed on May 19, 2020.

Figure 70. Example of habitat near Sally May Wash in Fossil Creek, surveyed on May 19, 2020.

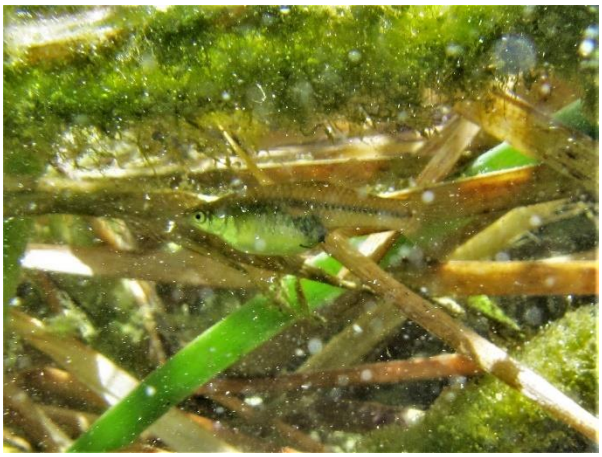

Figure 71. Gila Topminnow observed 1.5km downstream from Fossil Creek Dam on May 20, 2020.

Figure 72. Upstream view of location in Fossil Creek where Gila Topminnow were observed on May 20, 2020.

Figure 73. Downstream view of location in Fossil Creek where Gila Topminnow were observed on May 20, 2020.

Figure 74. Example of habitat targeted with minnow traps upstream of Fossil Creek Dam.

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Appendix A – supplementary graphs

List of figures

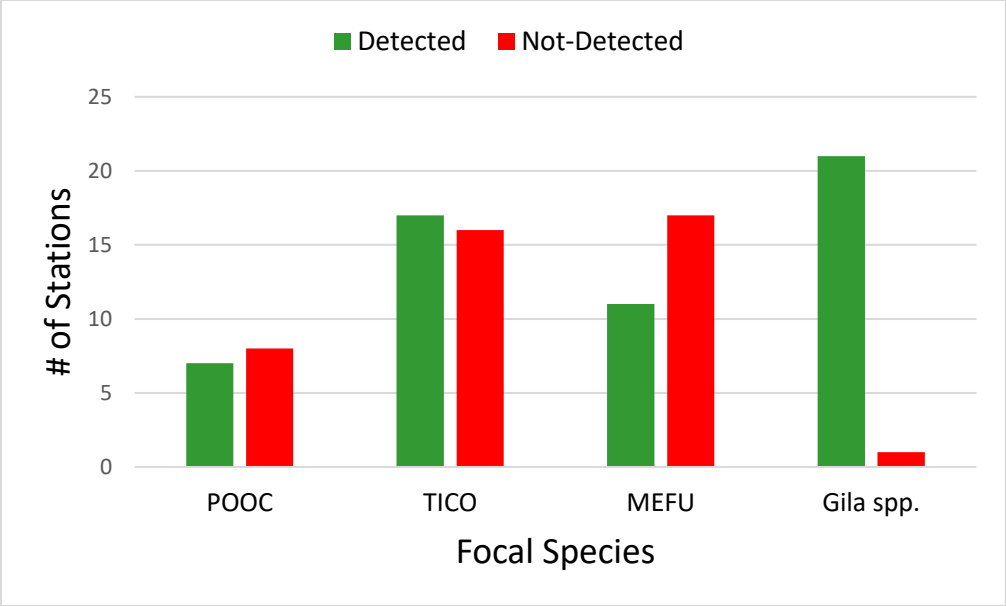
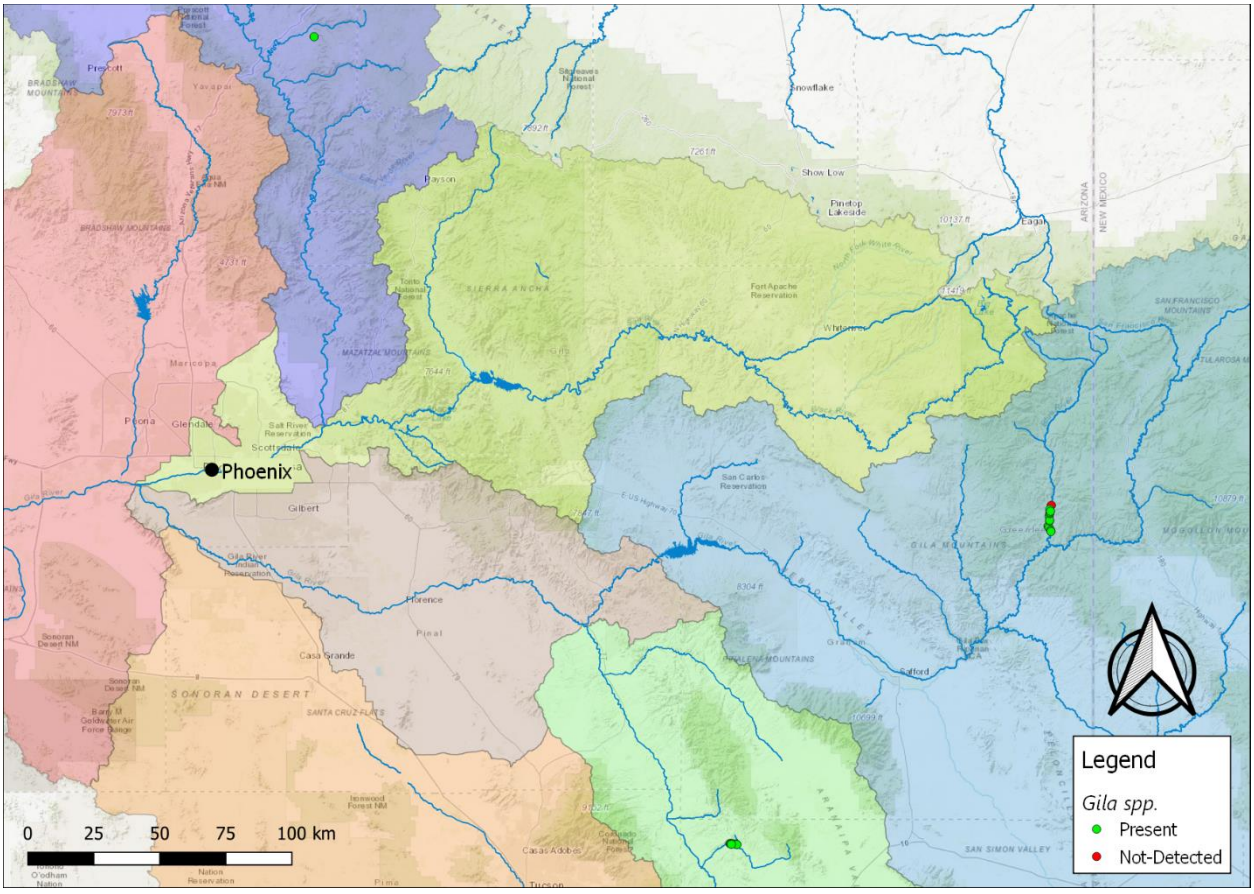


Figure A1. Number of stations where focal species were detected or not detected in selected streams of Gila River basin, 2020; see Table 1 for species codes. (Note: Some stations had more than 1 focal species)



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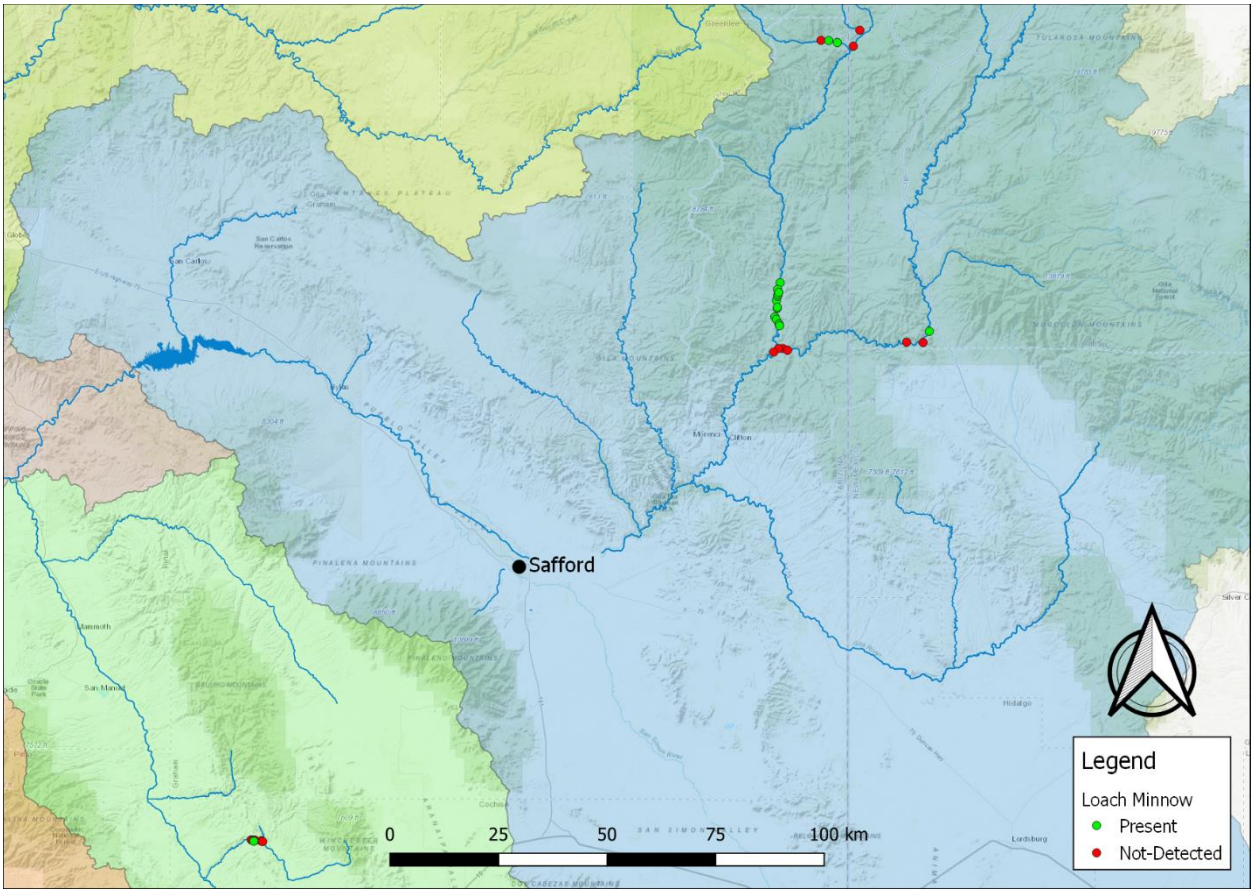

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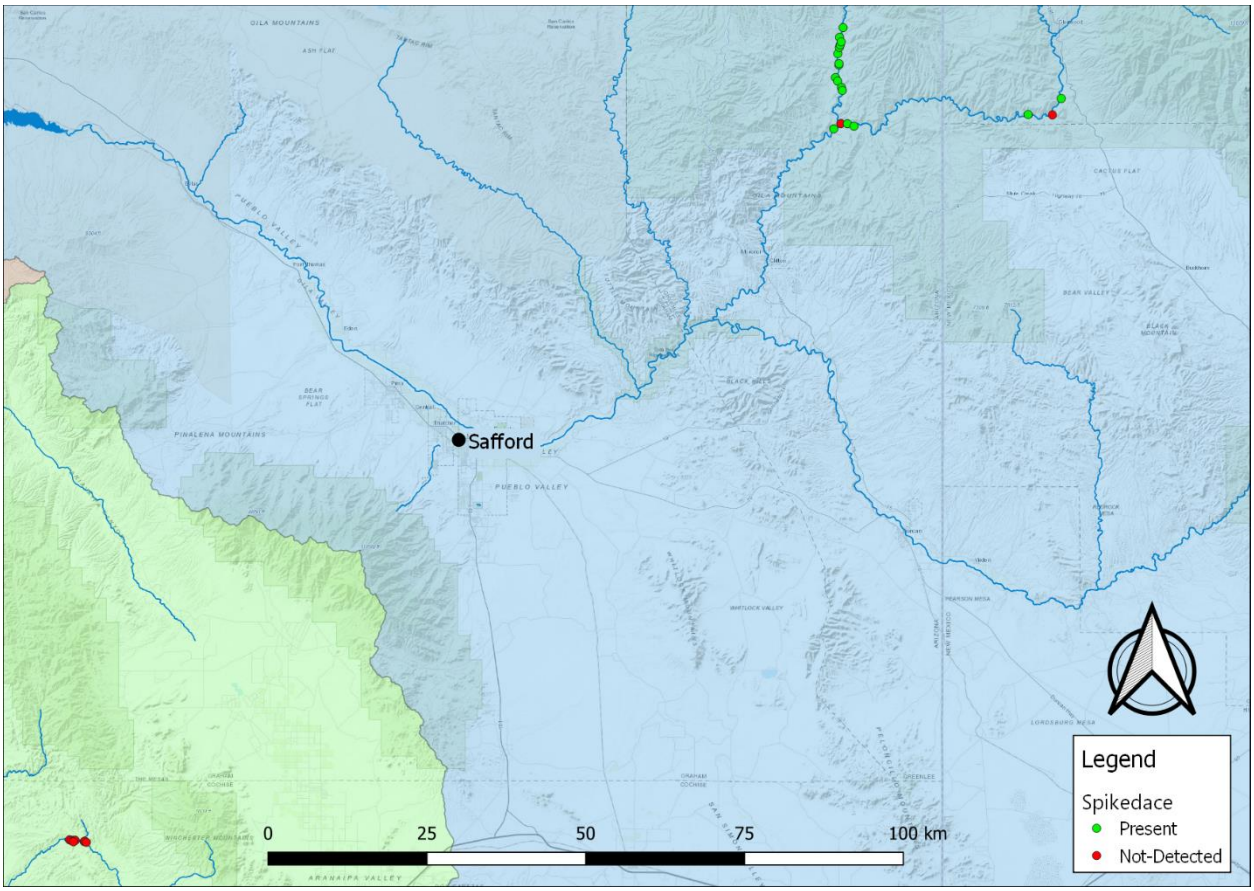

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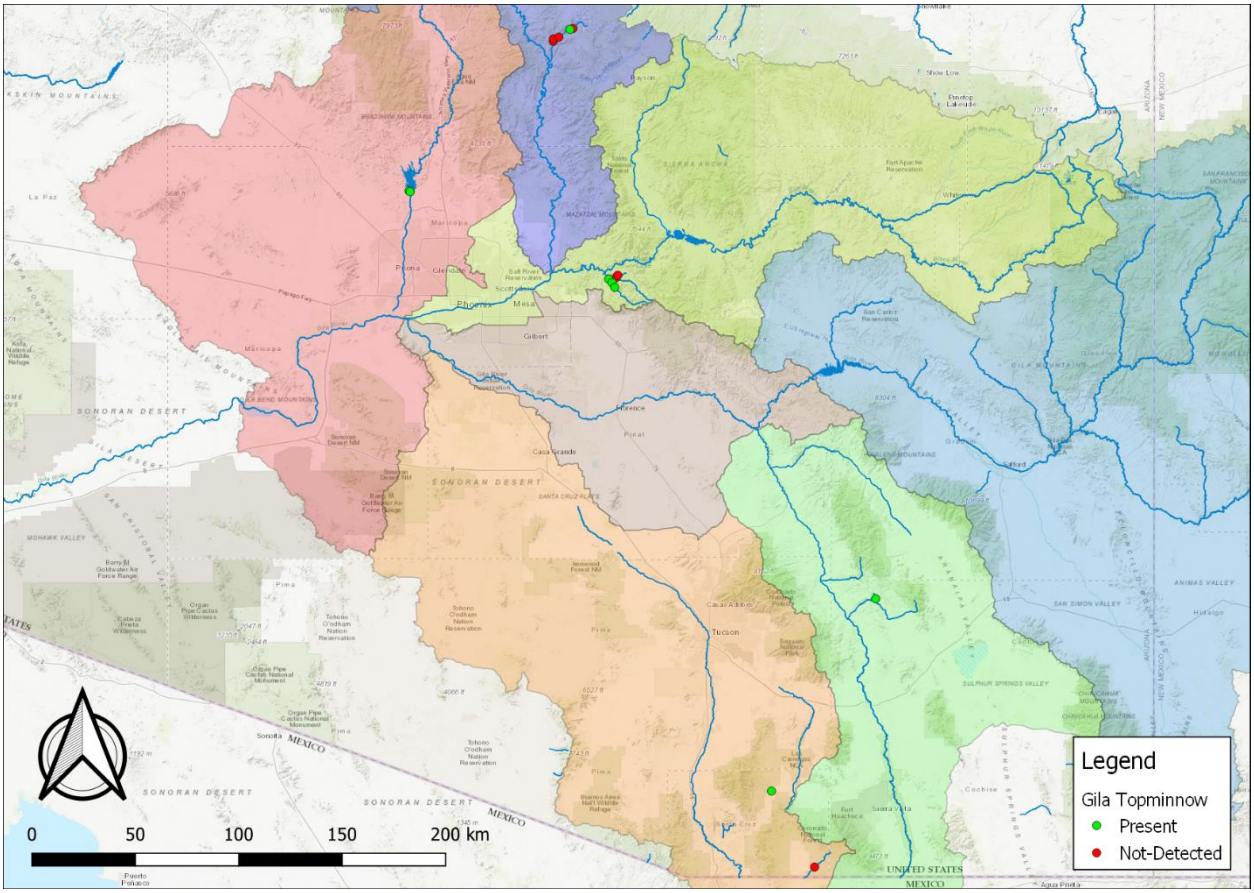

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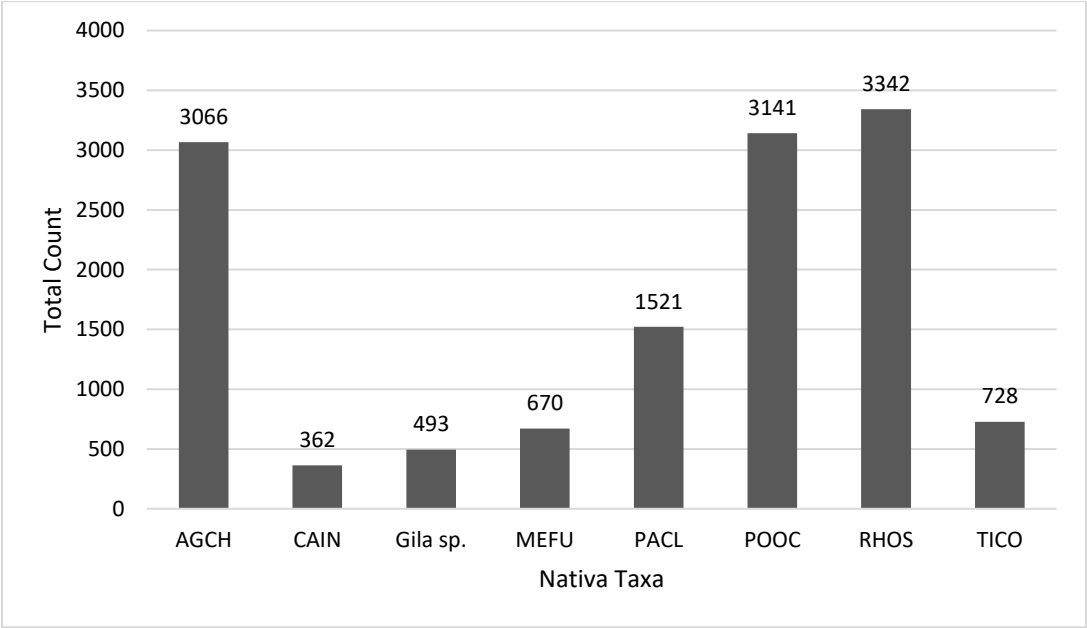
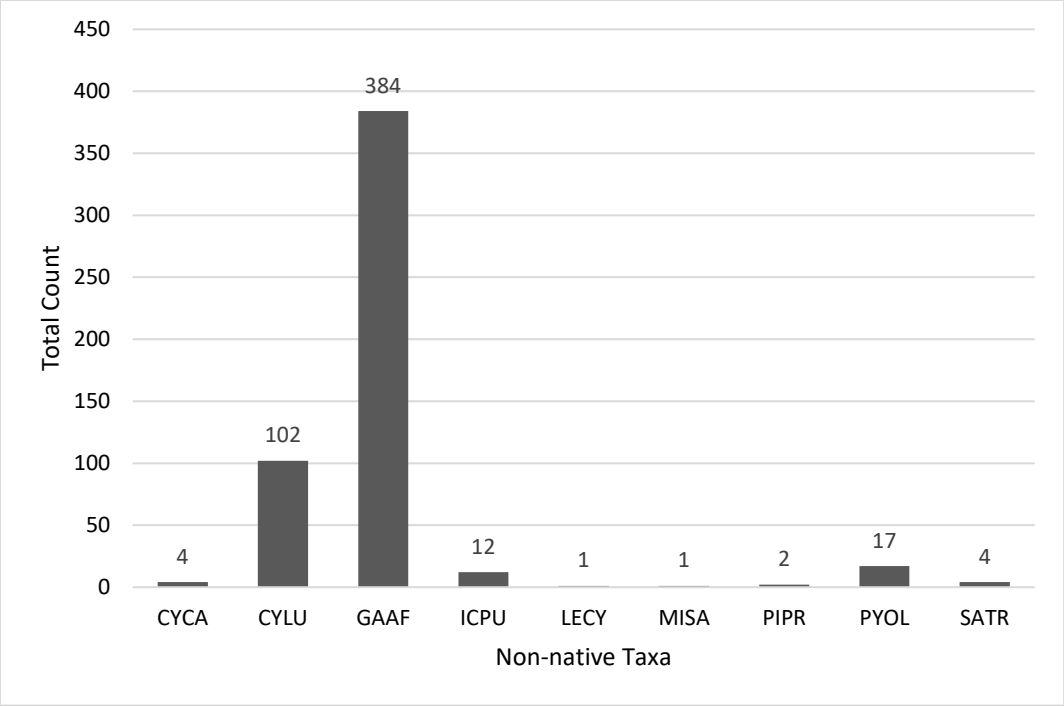


Figure A6. Total number of native taxa captured in selected streams of Gila River basin, 2020; see Table 1 for species codes.



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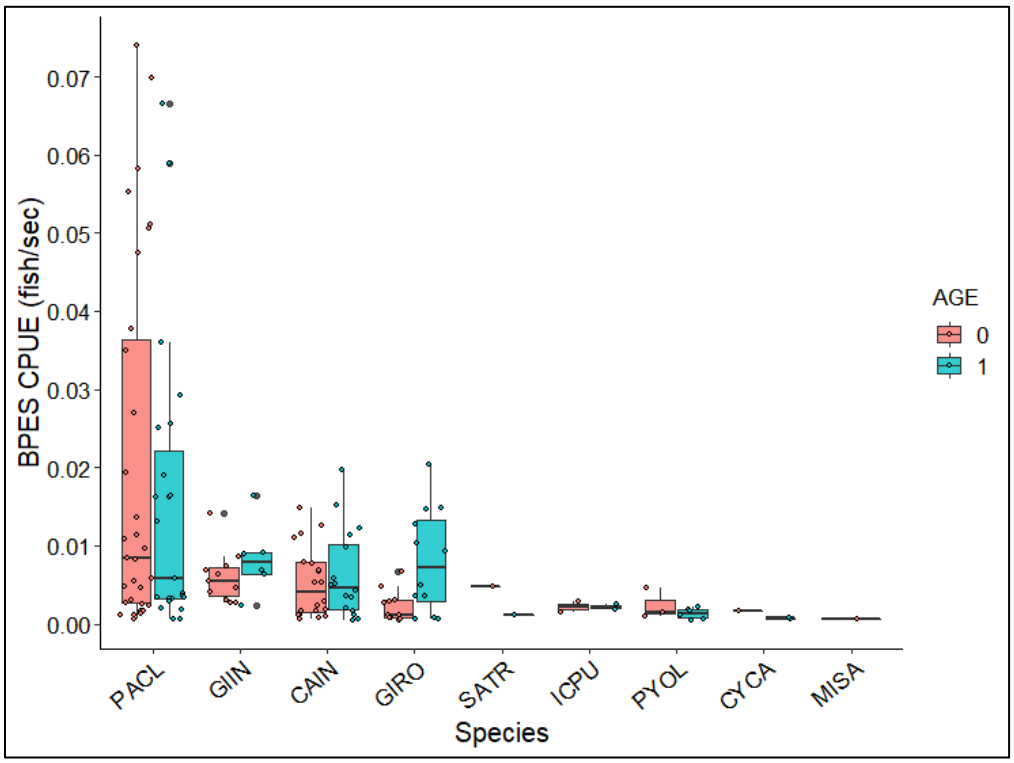

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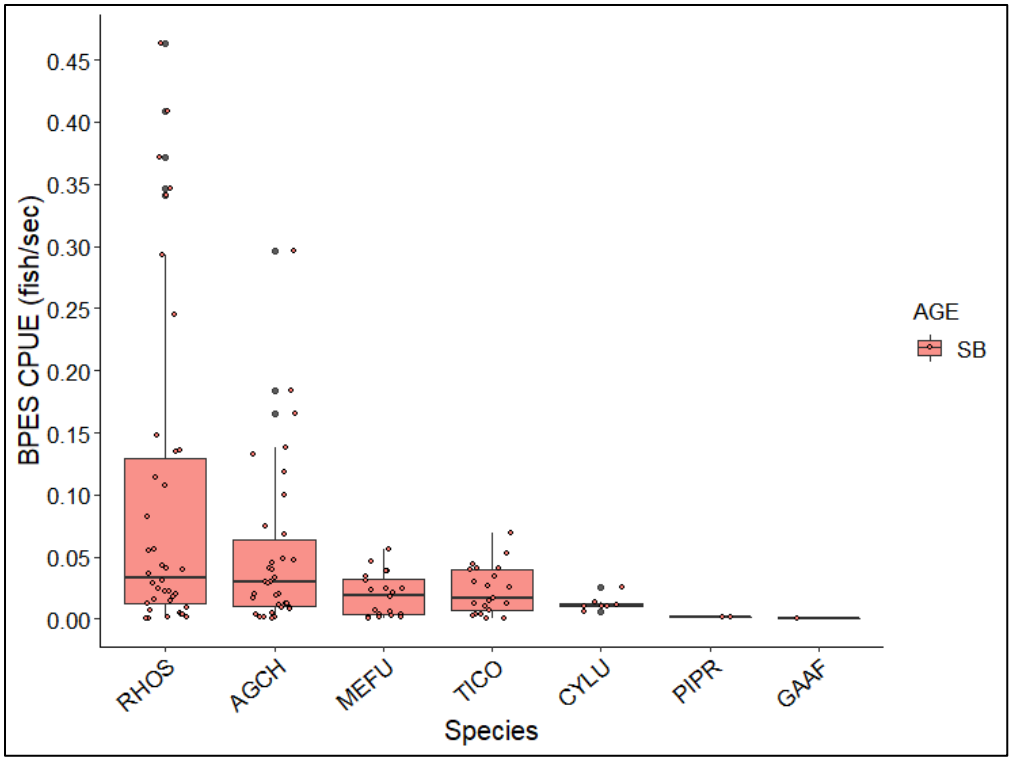

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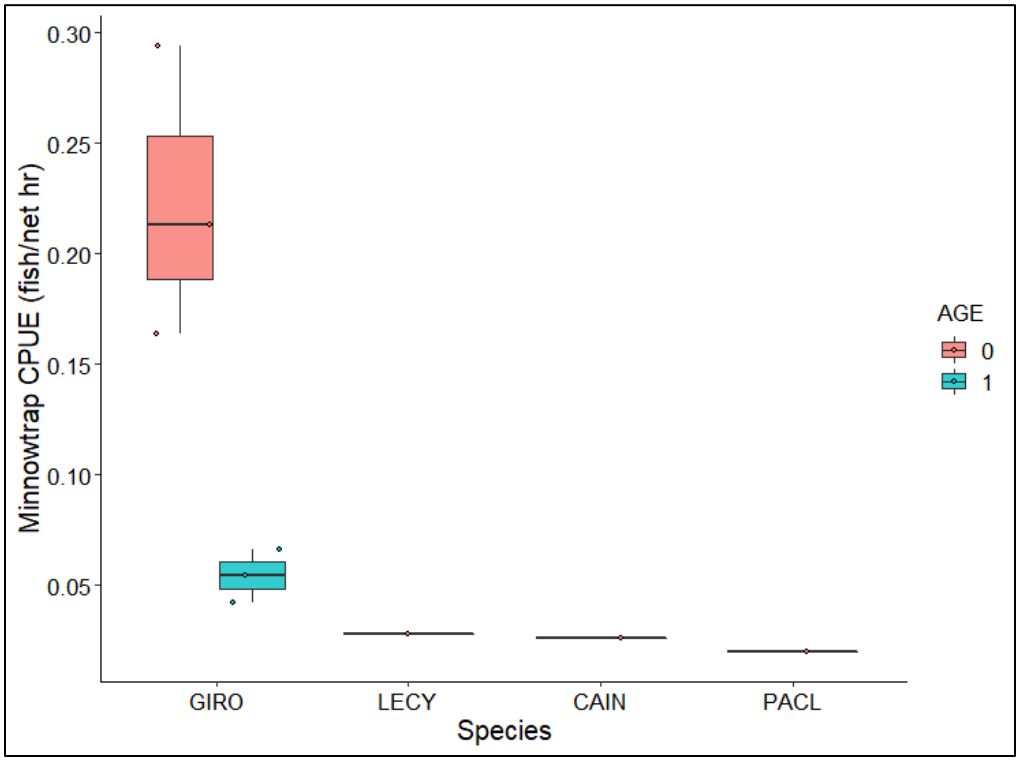

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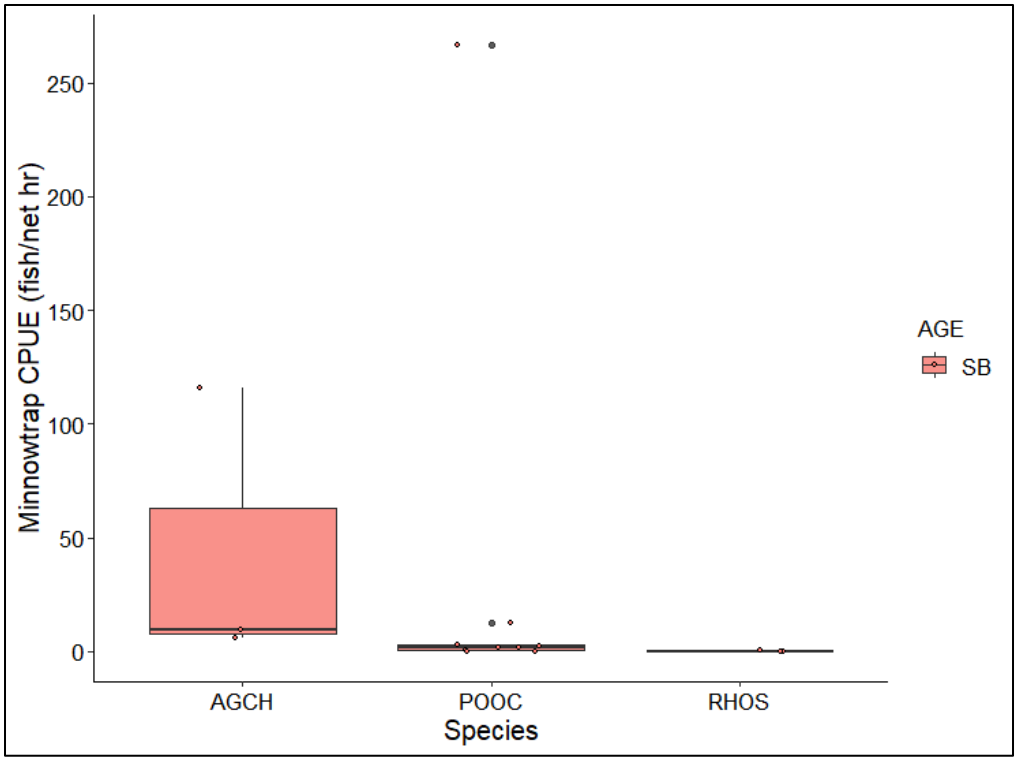

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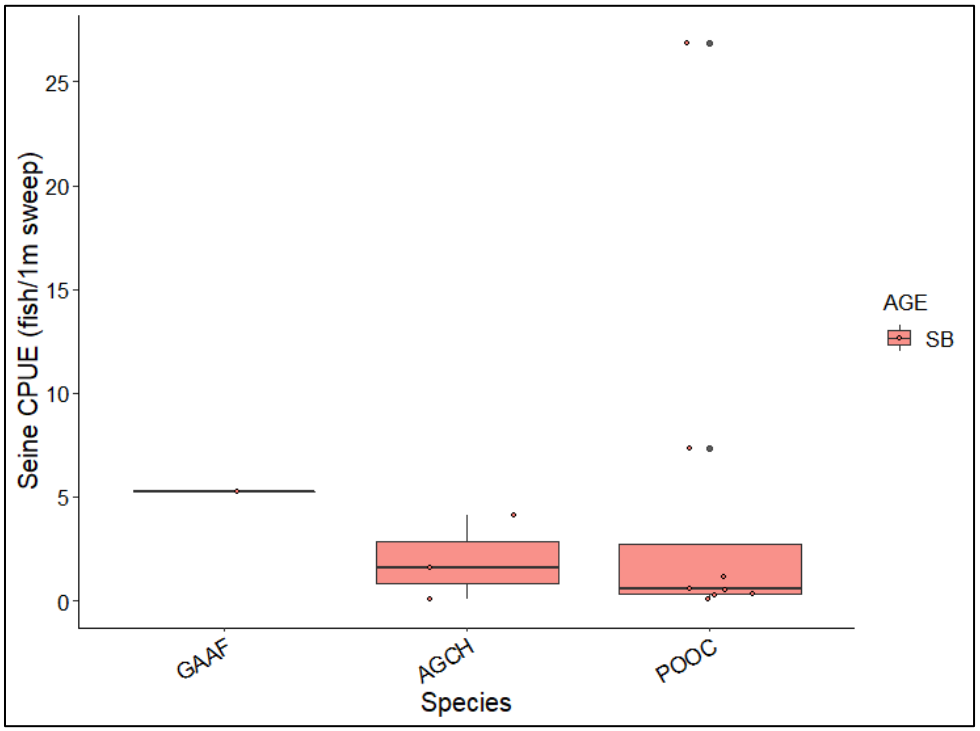

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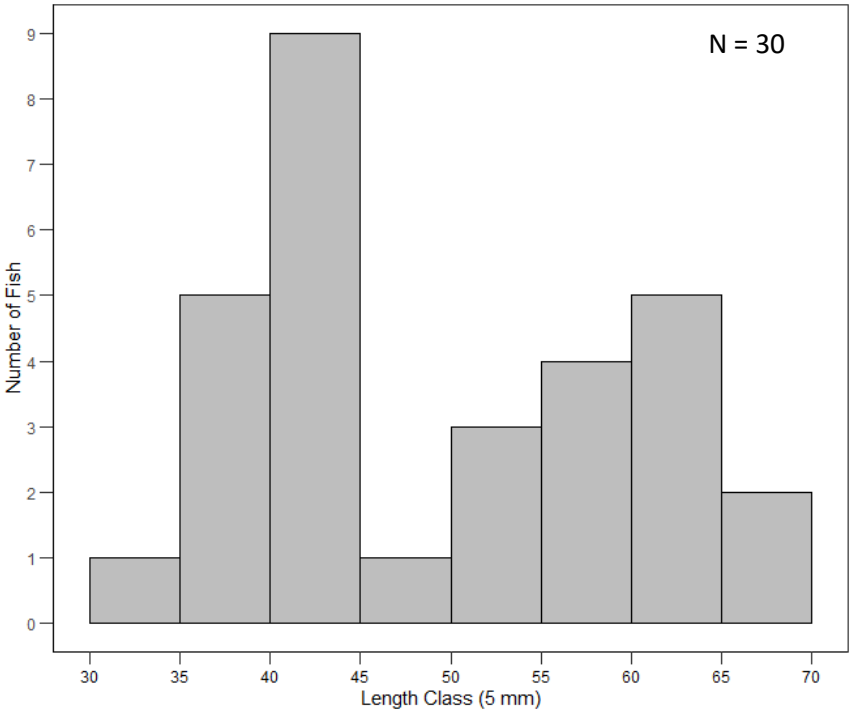

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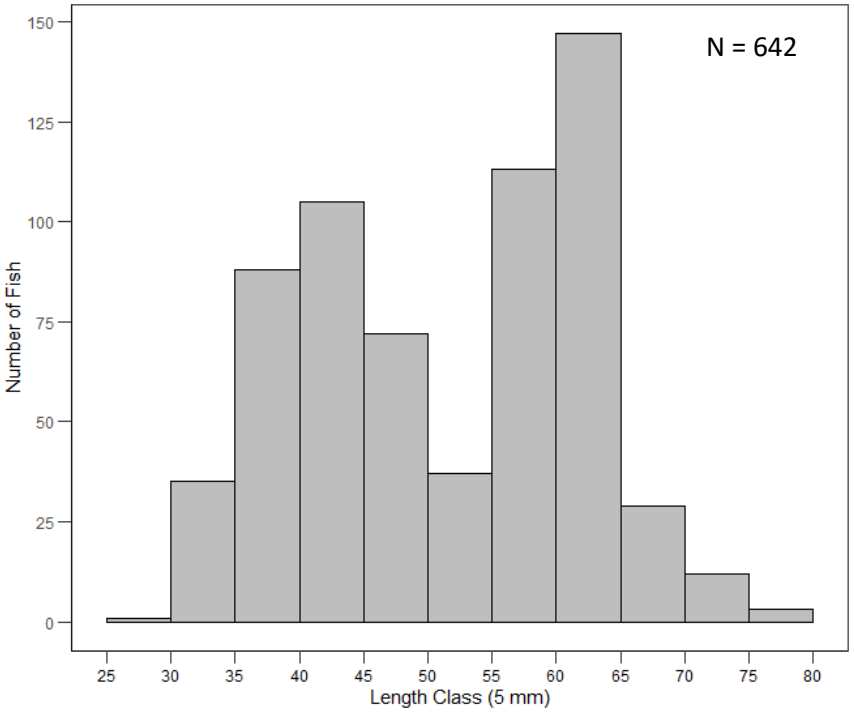

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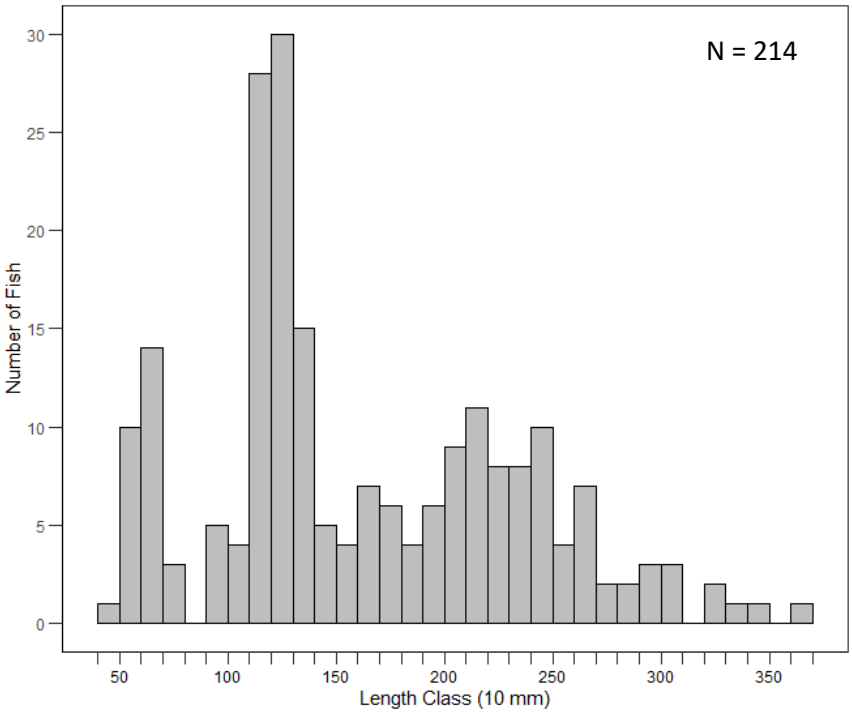

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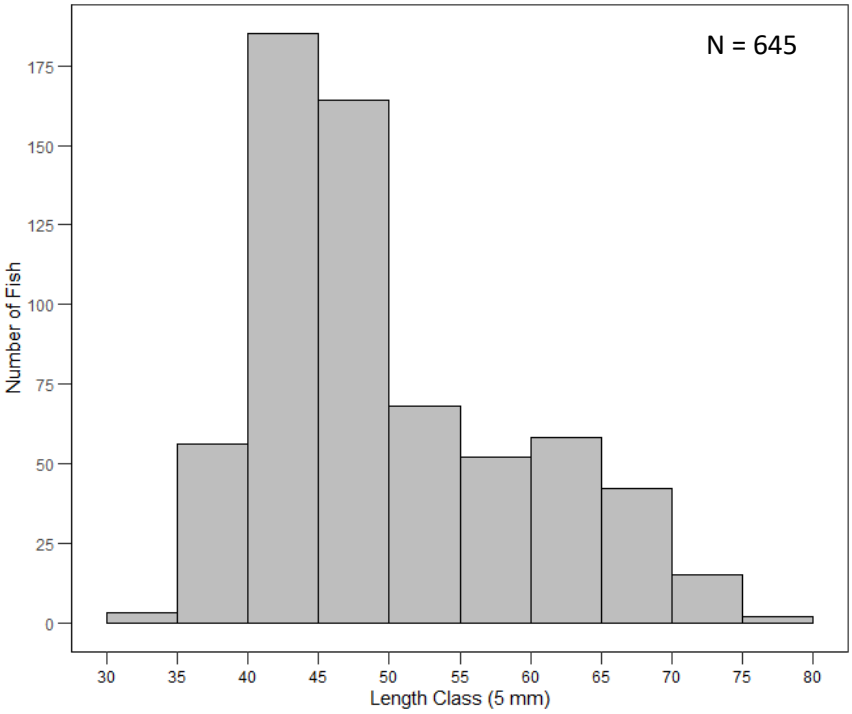

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