Gila River Basin Native Fish Monitoring

2024 Annual Report

Paul C. Reap, Brian R. Kesner, and Paul C. Marsh
Marsh & Associates, LLC
1024 E Vista Del Cerro Dr.
Tempe, Arizona 85281

Submitted to

Kent Mosher, COR
Bureau of Reclamation
Phoenix Area Office
6150 West Thunderbird Road
Glendale, Arizona

In behalf of Reclamation Contract No. 140R3022F0030

April 2025

Table of Contents

List of Tables

List of Figures

Introduction

Long-term monitoring at multiple spatial scales through time (i.e., temporal) provides important insight on distribution, abundance, and dynamics of stream fish communities. In 1994, a long-term monitoring program was initiated by Bureau of Reclamation (Reclamation) as a requirement imposed by 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). FWS determined that the canal and its interconnected channels had potential to degrade fish habitat as the CAP provided a mechanism for dispersal of non-native fishes into surrounding aquatic systems. The initial monitoring program objective was to provide baseline data on distribution and abundance of non-native fishes in the CAP canal system and its primary connected waters. In 2012, Reclamation and FWS in collaboration with Arizona Game and Fish Department (AZGFD) and New Mexico Department of Game and Fish (NMDGF) shifted focus further upstream of the CAP canal system to gather information on the status of wild populations of federally listed and candidate fishes.

The primary objective of the current monitoring program is to identify presence and distribution of each target species in the streams being monitored. Secondarily, evaluate fish community structure to determine relative abundance of focal species within the community of co-occurring fishes. Moving forward, the program goal will be to better assess conservation status of federally listed focal species by calculating population size indices, determining fish assemblage structure including non-natives, documenting reproduction and recruitment, and determining geographic extent for each focal species (Mosher et al. 2020). Species specific objectives and standardized protocols will assist with meeting this goal.

This report summarizes monitoring activities conducted by Marsh & Associates, LLC (M&A) during calendar year 2024 for the Gila River Basin Native Fish Monitoring Project (GRBNFMP). Here, detailed trip summaries with catch data are reported, results are summarized across sub-basins, sampling gears are qualitatively evaluated, and trends of recruitment and size-structure are examined where possible.

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

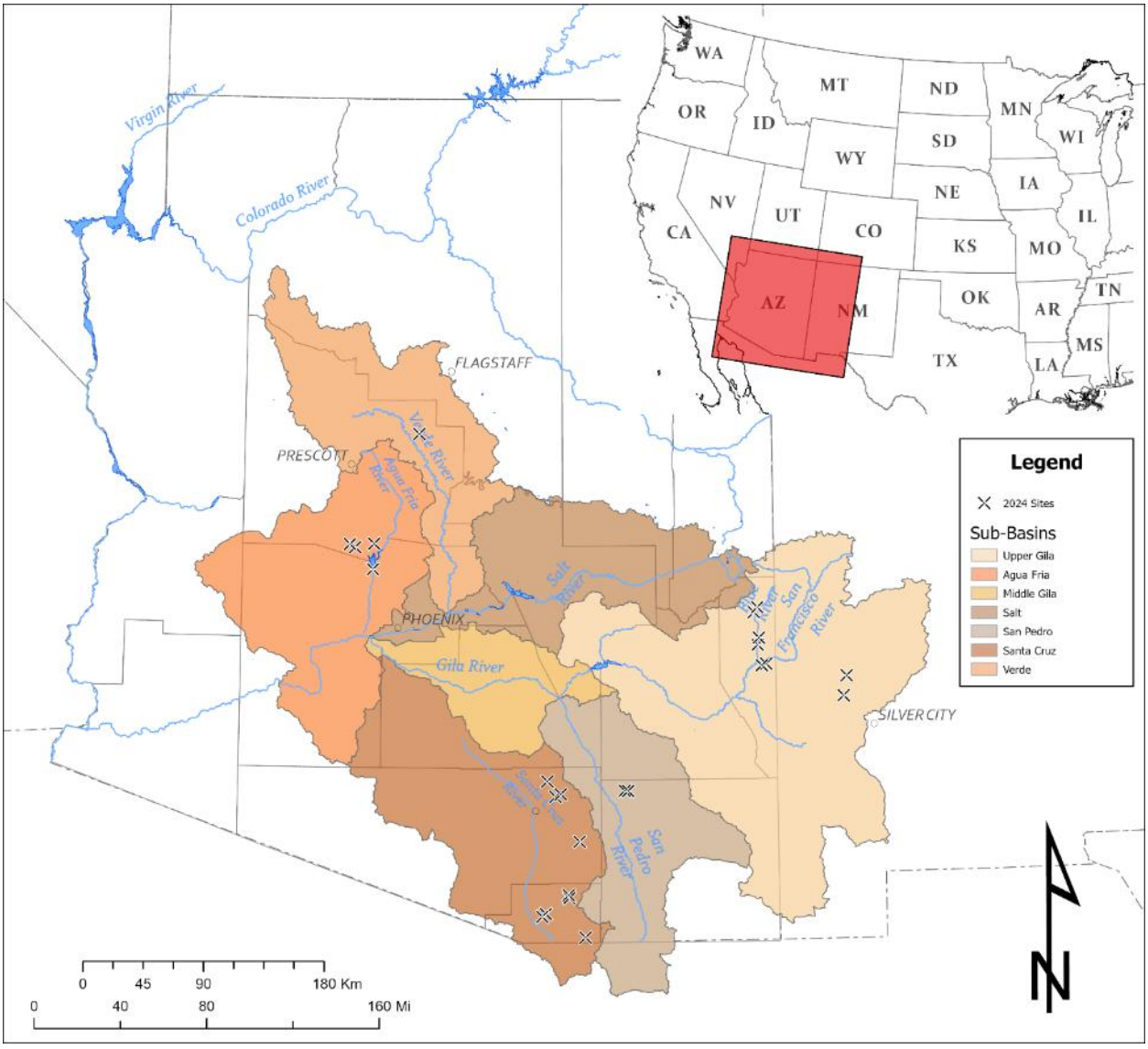

Figure 1. Major drainages of the Gila River basin, Arizona, and New Mexico, where stream surveys were conducted in 2024.

Methods

A new, generalized sampling design and methodology, including site-specific monitoring protocols, was implemented in 2021, and has been utilized since. Sampling methodologies followed Mosher et al. (2020), and any deviations are reported in the trip summaries section below. Uniform application of these methods will help improve consistency regarding survey timing, effort, and sampling locations moving forward. Standardized methods allow for more informative comparisons across years. Primary methods of sampling were backpack electrofishing ([BPEF]; Smith-Root LR-20B Electrofisher), large hoop nets (29 in x 24 in, ¼ in mesh), Promar collapsible mini-hoop nets (hereafter mini-hoop nets; 12 in x 24 and 36 in, ½ in mesh), 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), and seine (12 ft x 4 ft, 0.118 in mesh).

Site-specific monitoring protocols were established for each stream (Mosher et al. 2020); generally, gear selection was determined by focal species and habitat type. In addition, protocols differed slightly for Arizona versus New Mexico streams because of differing data preferences of the fish management agencies in the two states. In New Mexico, all survey stations were 200-meters (m) in length compared to 100-m in Arizona (except for the lower Blue River, which has 200-m survey stations). Regardless, segment length of stream sampled during a given study year is enough to cover at least 20% of available habitat at a site. Sites typically consisted of at least one fixed station and remaining stations were randomly determined, 100-m or 200-m intervals that were generated using QGIS software. Potential survey stations were numbered beginning at 01 for the most upstream station and continuing downstream. A random number generator was used to assign random stations to be sampled for each monitoring event.

Survey stations were subdivided into mesohabitat types (Riffle, Run, Pool) and efforts were recorded individually for each type. For example, at the end of each habitat during an electrofishing survey, electrofishing seconds were recorded, all fishes captured were processed, and information such as habitat type, length, width, depth (if a pool) were recorded. Catch totals and effort were recorded individually for each mini-hoop net or minnow trap set, dip net sweep, and seine haul.

At each processing point, fishes were identified to species (Table 1) and counted. All Gila Chub, Spikedace, Loach Minnow, and non-native piscivores captured were measured for total length (TL, in millimeters [mm]). In addition, Gila Chub were weighed to the nearest gram. Lengths of other species were categorized into general size classes: ≤20 and >20 mm TL for Gila Topminnow and Western Mosquitofish *Gambusia affinis*, ≤40 and >40 mm TL for other small-bodied fishes (e.g., Speckled Dace *Rhinichthys osculus* and Longfin Dace *Agosia chrysogaster*), and ≤50, 51-100 and >100 mm TL for large-bodied fishes (e.g., Desert Sucker *Pantosteus clarkii* and Sonora Sucker *Catostomus insignis*).

Station lengths were measured in the field using a Garmin 66i GPS unit. UTM coordinates of upper and lower boundaries of each reach were recorded in NAD83 datum. Habitat photographs were taken at each random station as were specimen photos of species or individuals of interest. At fixed stations, photographs were taken at upper and lower boundaries of both upstream and downstream views. Water physico-chemical parameters (temperature, dissolved oxygen [DO], pH, and conductivity) were measured at fixed stations. At stream sites, discharge at fixed stations was estimated from velocity and depth measurements across 10 intervals using a HACH® FH950. Discharge protocol was a modified version of that developed by U.S. Environmental Protection Agency (Lazorchak et al. 1998).

Table 1. List of species encountered during surveys throughout the Gila River Basin in 2024.

Common name	Code	Scientific Name
Apache Trout	ONAP	*Oncorhynchus apache*
Brown Trout	SATR	*Salmo trutta*
Desert Sucker	PACL	*Pantosteus clarkii*
Fathead Minnow	PIPR	*Pimephales promelas*
Flathead Catfish	PYOL	*Pylodictis olivaris*
Gila Chub	GIIN	*Gila intermedia*
Gila Topminnow	POOC	*Poeciliopsis occidentalis*
Green Sunfish	LECY	*Lepomis cyanellus*

Loach Minnow	TICO	*Tiaroga cobitis*
Longfin Dace	AGCH	*Agosia chrysogaster*
Roundtail Chub	GIRO	*Gila robusta*
Sonora Sucker	CAIN	*Catostomus insignis*
Speckled Dace	RHOS	*Rhinichthys osculus*
Spikedace	MEFU	*Meda fulgida*
American Bullfrog	RACA	*Rana catesbeiana*
Canyon Treefrog	HYAR	*Hyla arenicolor*
Lowland Leopard Frog	RAYA	*Rana yavapaiensis*
Northern Crayfish	FAVI	*Faxonius virilis*
Black-necked Gartersnake	THCY	*Thamnophis cyrtopsis*
Black-tailed Rattlesnake	CRMO	*Crotalus molossus*
Gophersnake	PICA	*Pituophis catenifer*
Ring-necked Snake	DIPU	*Diadophis punctatus*

Data summary and analyses

Fish capture data were summarized and compiled in tabular form, separately for each stream, that provide numerical, catch-per-unit effort (CPUE), and relative abundance for each species and each age (size) class. Length-frequency histograms were included where data were available to evaluate size-structure and reproduction. Also, a narrative text was included that summarizes trip details and fish community composition. Status of focal species was assessed in contexts of physical habitat conditions, 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. Station maps were constructed in ArcGIS version 10.8 (Esri, Redlands, CA).

Comparisons with previous surveys completed under this monitoring program were included where adequate data existed. GRBNFMP surveys completed before 2021 utilized a different sampling protocol, therefore meaningful CPUE comparisons were not possible in some instances. TL typically was not recorded during these previous years, so size-structure comparisons were limited. Population size and recruitment trends will be examined in future years as the current sampling protocol is maintained. Raw data from 2012-2019 were provided for Hot Springs Canyon and lower Blue River by Reclamation, which enabled a rolling 10-year CPUE trend analysis. CPUE for these surveys were calculated per station and then summarized for each year.

Results

A total of 127 sampling stations were completed across 24 streams. Gila Chub were detected at 36 of 53 stations (8 of 9 streams) where they were a focal species, Spikedace at 17 of 46 stations (2 of 3 streams), Loach Minnow at 14 of 60 stations (4 of 6 streams), and Gila Topminnow at 14 of 40 stations (8 of 12 streams) where they were a focal species.

Across all streams, a total of 25,953 individuals across 13 fish species (10 native and 3 non-native) was captured (Table 2). Compared to the previous rotation of these sites sampled in 2021, total catch doubled

from 12,578 individuals caught. Fires experienced in 2020 and 2021 in this region had a devastating impact on fish assemblages. At most sites where fires had an impact, for example, lower Blue River, lower Turkey Creek, Romero Canyon, and Sabino Canyon fish assemblages appear to have recovered. The addition to the protocol of middle Blue River, Grant Creek, KP Creek, Spring Creek and Harden Cienega Creek could also explain the increase in total catch. Across these five sites 5,566 individuals were captured, which attributed 41.6% of the catch difference. However, four sites located in the East Fork Black River were not conducted in 2024 but were sampled in 2021.

Native taxa accounted for 99.31% of total catch. BPEF was the primary sampling gear and was used at 77 sampling stations. BPEF was effective at capturing both large and small-bodied fishes and accounted for 66.11% (n=17,160) of total catch. Total effort for BPEF in 2024 was 56,336 seconds. However, BPEF was not effective in stream reaches with deep pools or high turbidity. Minnow traps were employed at 23 stations to target Gila Topminnow and young-of-year (YOY) Gila Chub in pools. Minnow traps accounted for 28.41% (n=7,373) of total catch. Seining was employed at three stations in deeper pools and flowing habitat with smooth substrate and accounted for 3.67% (n=953) of total catch. Other gears were used less frequently, such as dip-net sweeps that targeted Gila Topminnow in shallow, vegetated stream margins at eight stations and accounted for 1.04% (n=269) of total catch. Mini-hoop nets were employed to target adult Gila Chub in springs and deep pools at five different stations and accounted for 0.43% (n=114) of total catch.

Mesohabitat encountered in 2024 differed from the previous rotation of surveys conducted at the same sites in 2021 (Figure 2). The total distance of dry habitat encountered this year increased from 873.9 m in 2021 to 3,749.9 m. This was a marked increase considering the total wetted distance encountered was 11,105.2 m in 2024 from 12,090.6 m in 2021. Dry habitat was the second most common habitat encountered behind riffles, which accounted for 5,405.2 m of surveyed habitat. This year more than twice the amount of dry habitat since the monitoring protocol was established in 2021 was encountered. This dryness was attributed to drought conditions (Figure 3) and could negatively impact fish populations if the trend continues. The change in habitat could also explain the increase in catch totals for 2024. If fish communities were less dispersed, but just as abundant, more fish were likely to be caught with comparable effort. These observations could be dependent on the year, as most sites sampled are on three or five-year rotations. Continued monitoring of total sampled mesohabitat could indicate changes in available habitat for focal species across years where site sampling is similar and could explain differing catch totals for target species.

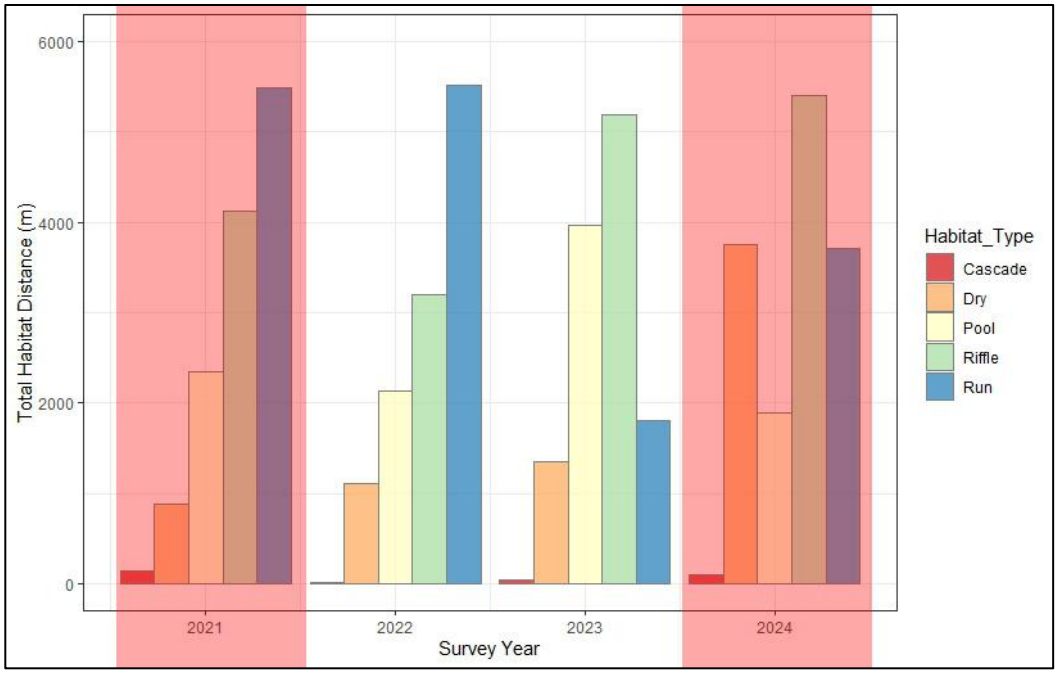

Figure 2. Total distance (m) of habitat encountered in surveys conducted in the Gila River Basin, 2021-2024. Highlighted columns are survey years in the same 3-year rotation of sites.

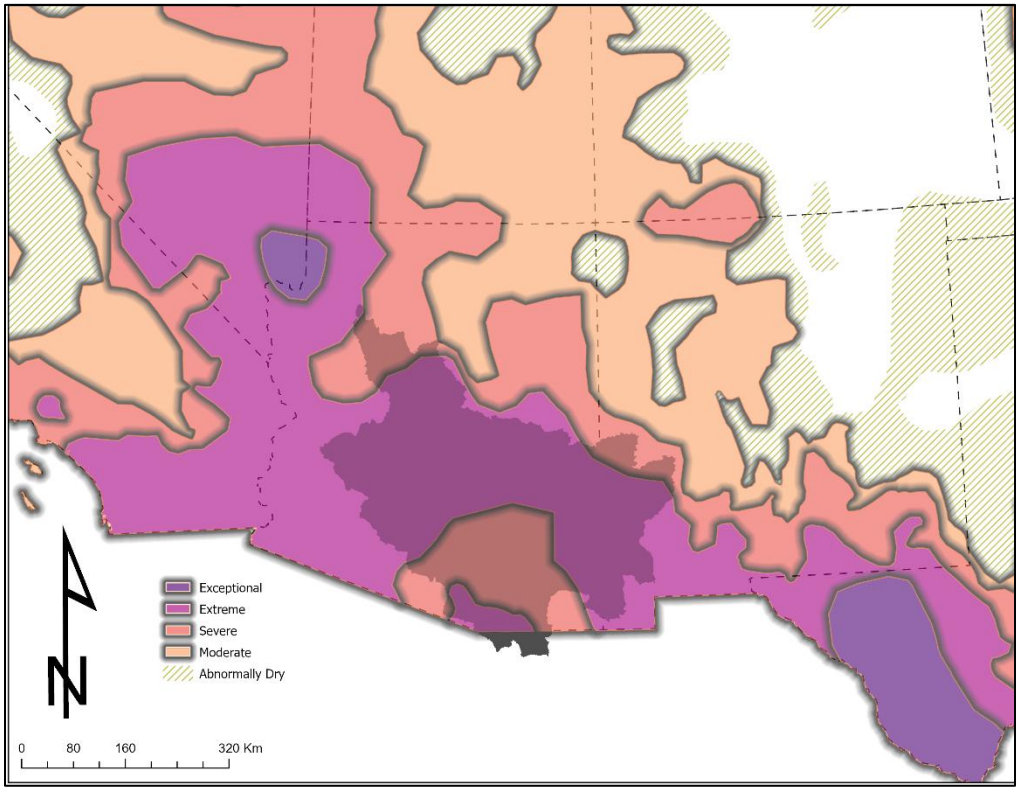

Figure 3. Map of the Gila River Basin Watershed showing drought severity based on data from U.S Drought Monitoring (USDM) as of February 18, 2025. Slightly darkened area represents the Gila River basin.

Table 2. Summary of fish species captured by stream, Gila River basin, Arizona, 2024. Focal species captures for each stream are highlighted in yellow. Streams listed in alphabetic order; species codes are in Table 1.

Stream	AGCH	CAIN	GIIN	GIRO	LECY	MEFU	ONAP	PACL	PIPR	POOC	PYOL	RHOS	SATR	TICO	Catch
AD Wash	-	-	-	-	-	-	-	-	-	393	-	-	-	-	393
Bass Canyon	10	97	668	-	-	-	-	15	-	-	-	164	-	-	954
Bear Canyon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Bear Creek	1,725	362	-	-	-	-	-	698	-	-	-	-	-	253	3,038
Buckhorn Spring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78
Cienega Creek	3,842	-	-	-	-	-	-	-	-	-	-	-	-	-	3,842
Coal Mine Canyon	113	-	-	-	-	-	-	-	-	299	-	-	-	-	412
Cottonwood Spring	-	-	-	-	-	-	-	-	-	200	-	-	-	-	200
Dix Creek	290	20	253	-	-	-	-	355	-	-	-	348	-	-	1,266
Fresno Canyon	213	-	-	-	3	-	-	-	-	466	-	-	-	-	688
Grant Creek	-	1	-	-	-	-	76	5	-	-	-	251	-	-	333
Harden Cienega Creek	14	48	69	-	-	-	-	393	-	-	-	125	-	-	649
Hot Springs Canyon	1,168	17	102	-	-	-	-	137	-	-	-	1,158	-	43	2,625
KP Creek	2	6	-	-	-	-	-	43	-	-	-	197	14	-	262
Lower Blue River	476	573	-	303	-	182	-	2,235	-	-	-	532	-	1	4,302
Lower Turkey Creek	369	181	36	-	-	-	-	621	1	-	1	18	-	-	1,227
Middle Blue River	334	114	-	13	-	12	-	1,265	-	-	-	1,156	-	17	2,911
Monkey Spring	-	-	-	-	-	-	-	-	-	51	-	-	-	-	51
Morgan City Wash	80	-	-	-	77	-	-	-	-	195	-	-	-	-	352
Romero Canyon	-	-	122	-	-	-	-	-	-	-	-	-	-	-	122
Sabino Canyon	-	-	190	-	-	-	-	-	-	-	-	-	-	-	190
Sheehy Spring	-	-	46	-	-	-	-	-	-	-	-	-	-	-	46
Spring Creek	104	-	424	-	-	-	-	-	-	661	-	143	-	-	1,332
Tule Creek	-	-	-	-	-	-	-	-	-	680	-	-	-	-	680
Total	**8,740**	**1,419**	**1,910**	**316**	**80**	**194**	**76**	**5,767**	**1**	**2,945**	**1**	**4,092**	**14**	**314**	**25,953**

Trip Summaries

Agua Fria Basin

Morgan City Wash May 6, 2024

Station		Lower Boundary	Upper Boundary
MCW05	12S NAD83	381348E, 3745092N	381323E, 3745191N
MCW08-F		381557E, 3744920N	371495E, 3744999N
MCW12		381762E, 3744671N	381707E, 3744743N

Morgan City Wash (Maricopa Co., AZ) is a tributary to Agua Fria River located just SW of Lake Pleasant. Perennial water exists for 1.5 km in the lower portion of the wash. Gila Topminnow (Sharp Spring lineage) was stocked into Morgan City Wash in 2009 and 2010 and have persisted there ever since (Gray 2018). Desert Pupfish *Cyprinodon macularius* also was stocked but failed to establish (Pearson et al. 2013). Gila Topminnow was the focal species for this site. Morgan City Wash was last surveyed for GRBMP in 2020 and 2021, resulting in captures of 37 and 1,898 Gila Topminnow, respectively (Shollenberger et al. 2022).

M&A personnel completed sampling of Morgan City Wash on May 6, 2024. All stations were accessed by hiking from Old Lake Pleasant Road. One fixed and two random stations were surveyed (Figure 4). Ten minnow traps were set and baited with dry dog food in each station for a minimum of 2 hours. Across the three stations, totals of 195 Gila Topminnow, 80 Longfin Dace, and 77 Green Sunfish *Lepomis cyanellus* were captured. Gila Topminnow abundance increased as sampling continued upstream (Table 3).

The primary mesohabitat in stations MCW05 and MCW08-F were shallow pools separated by shallow sandy riffles. Station MCW12 mesohabitat was predominately narrow runs. Water temperature, dissolved oxygen, pH, and conductivity were recorded at 20.5 °C, 5.8 mg/L, 7.85, and 1,049 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 5-8).

Gila Topminnow catch was less than 2021's survey when 1,898 Gila Topminnow were captured. For context, 97.3% (n=1,847) of the Gila Topminnow were captured in the most upstream station surveyed that year (MCW01). The most upstream station surveyed in this year's survey was MCW05, where 89.2% of Gila Topminnow were captured for a total of 174 individuals. Similar to 2021, higher Gila Topminnow densities were encountered moving upstream in 2024, but not to the same degree seen in 2021. Despite the relatively dramatic drop off in catch, it is likely that Gila Topminnow were more abundant in the unsampled upper extent of Morgan City Wash and this survey did not sample those areas due to the random nature of the sampling protocol.

This was the first year that Green Sunfish were detected upstream of the weir since 2018 after they failed to be detected in 2020 and 2021. This weir formerly acted as a barrier to non-native fish downstream; however, sediment deposition and damage to the weir has made it nonfunctional as a fish barrier. As a result, Green Sunfish have invaded the reach that were previously only occupied by Gila Topminnow and Longfin Dace. There is an additional natural barrier in the form of a small waterfall structure at the upstream extent of the fixed station (MCW08-F) that appears to be preventing upstream movement. Any movement of Green Sunfish further upstream could jeopardize the Gila Topminnow population in Morgan City Wash.

Table 3. Catch summary table of fish captured at Morgan City Wash, Maricopa Co., Arizona, May 6, 2024. Total effort was 69.5 trap hours.

Stations	Statistic	POOC <20	POOC >=20	AGCH <40	AGCH >=40	LECY	Totals
MCW05 (21.4 hrs)	Count	6	168	14	37	0	225
	% total catch	2.67%	74.67%	6.22%	16.44%	0.00%	100.00%
	CPUE (ind/hr)	0.28	7.86	0.66	1.73	0.00	10.53
MCW08-F (22.4 hrs)	Count	0	18	0	29	60	107
	% total catch	0.00%	16.82%	0.00%	27.10%	56.07%	100.00%
	CPUE (ind/hr)	0.00	0.80	0.00	1.29	2.68	4.77
MCW12 (25.7 hrs)	Count	0	3	0	0	17	20
	% total catch	0.00%	15.00%	0.00%	0.00%	85.00%	100.00%
	CPUE (ind/hr)	0.00	0.12	0.00	0.00	0.66	0.78
	Count	6	189	14	66	77	352
	% total catch	1.70%	53.69%	3.98%	18.75%	21.88%	100.00%
	CPUE (ind/hr)	0.09	2.72	0.20	0.95	1.11	5.07

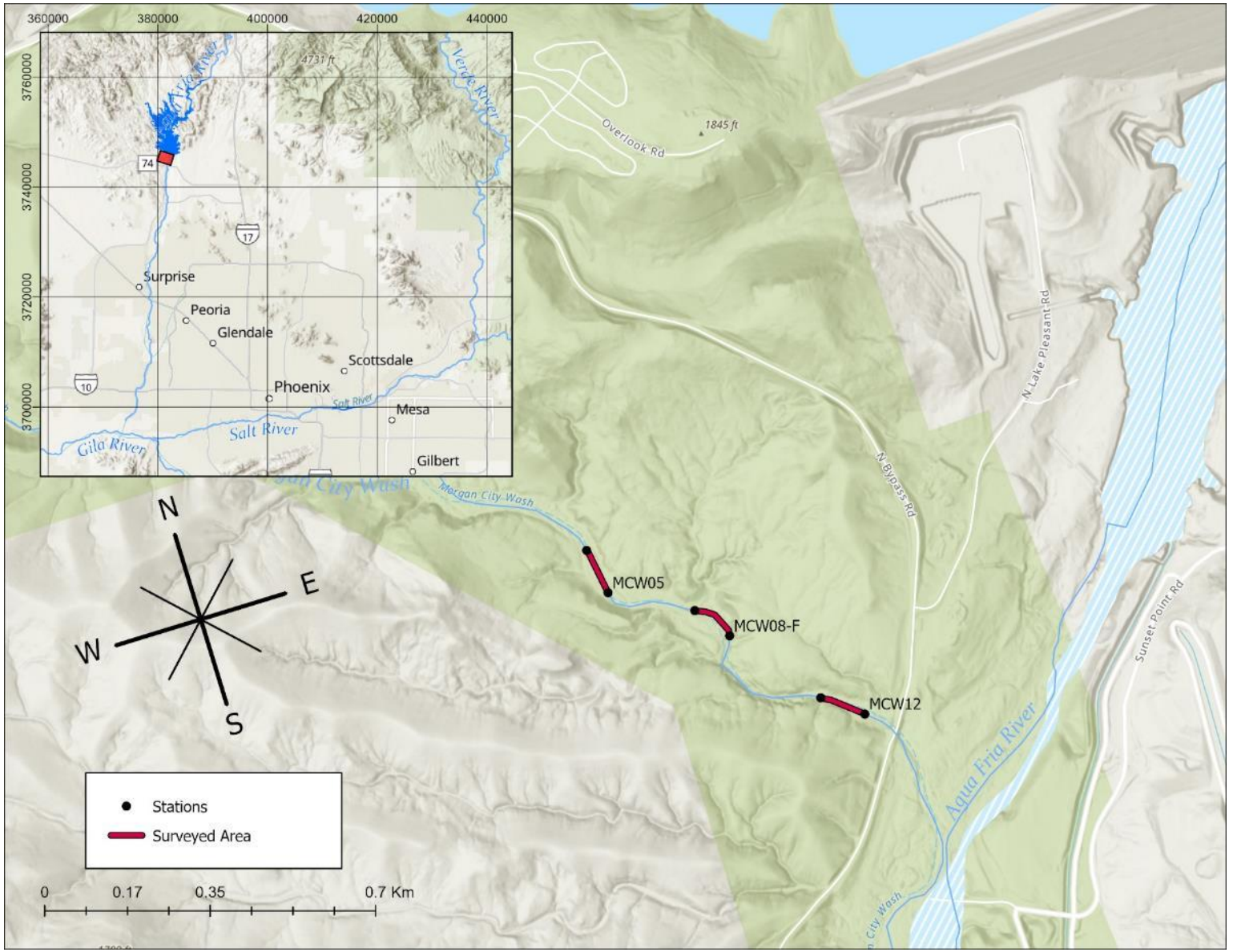

Figure 4. Location of sampled stations at Morgan City Wash, Maricopa Co., Arizona, Surveyed May 6, 2024.

Figure 5. Upstream to upstream view of MCW08-F, Morgan City Wash, Arizona.

Figure 6. Upstream to downstream view of MCW08-F, Morgan City Wash, Arizona.

Figure 7. Downstream to upstream view of MCW08-F, Morgan City Wash, Arizona.

Figure 8. Downstream to downstream view of MCW08-F, Morgan City Wash, Arizona.

AD Wash May 7, 2024

Station		Lower Boundary	Upper Boundary
ADW01-F	12S NAD83	368446E, 3761693N	368517E, 3761763N
ADW02-F		368415E, 3761591N	368446E, 3761693N
ADW03-F		368327E, 3761550N	368415E, 3761591N

AD Wash (Maricopa Co., AZ) is located approximately 18 km northwest of Lake Pleasant. A 500-m perennial section is located 6 km upstream of its confluence with Castle Creek. This section is within a stretch of steep canyon containing bedrock pools that typically are connected by shallow riffles. Sharp Spring lineage Gila Topminnow were stocked into AD Wash in 1993, and a population has been established ever since (Gray 2018). Gila Topminnow was the focal species at this site. The last two surveys conducted in 2018 and 2021 resulted in the capture of 212 and 670 Gila Topminnow, respectively (Burgad 2019, Shollenberger 2022).

M&A personnel surveyed AD Wash on May 7, 2024. This site was accessed by hiking down the drainage from Castle Hot Springs Road 350-m southwest from the most upstream station. I recommend hiking up drainage in future surveys. Three consecutive 100-m fixed stations were surveyed (Figure 9). The site was sampled with 10 minnow traps baited with dry dog food and set for a minimum of 2 hours.

The upper station (ADW01-F) was entirely dry, and ADW03-F had a 22-m run that was too shallow to sample. No fish were observed at the bookended stations. ADW02-F contained the only available habitat and consisted of three large pools varying from 1.2 – 1.4 m in depth. Ten traps were set in this station for approximately 2 hours and captured 393 Gila Topminnow. Catch and effort totals for all stations are summarized in Table 4. Numerous Gila Topminnow also were observed in an isolated pool 250-m upstream of our monitoring extent; however, this pool did not appear large enough to support perennial habitat.

At the time of survey, there was little surface connection between pools. Nearly 75% of the extent that was surveyed was dry. Average water temperature, dissolved oxygen, pH, and conductivity across two fixed stations (ADW02-F and ADW03-F) were 19.3 °C, 5.1 mg/L, 7.75, and 694 µS, respectively. Photographs of upper and lower extents of each fixed station are provided below (Figures 10-17).

Previous GRBMP surveys in 2021, 2018, and 2015 captured 670, 212, and 1,716 Gila Topminnow respectively in a single 100-m station. This population has shown high variability from year to year but appears resilient to ongoing drought conditions faced in the region.

Table 4. Catch summary table of fish captured at AD Wash, May 7, 2024, Maricopa Co., Arizona. Total effort was 20.8 trap hours.

Stations	Statistic	POOC >=20
ADW02-F (20.8 hrs)	Count	393
	% total catch	100%
	CPUE (ind/hr)	18.89

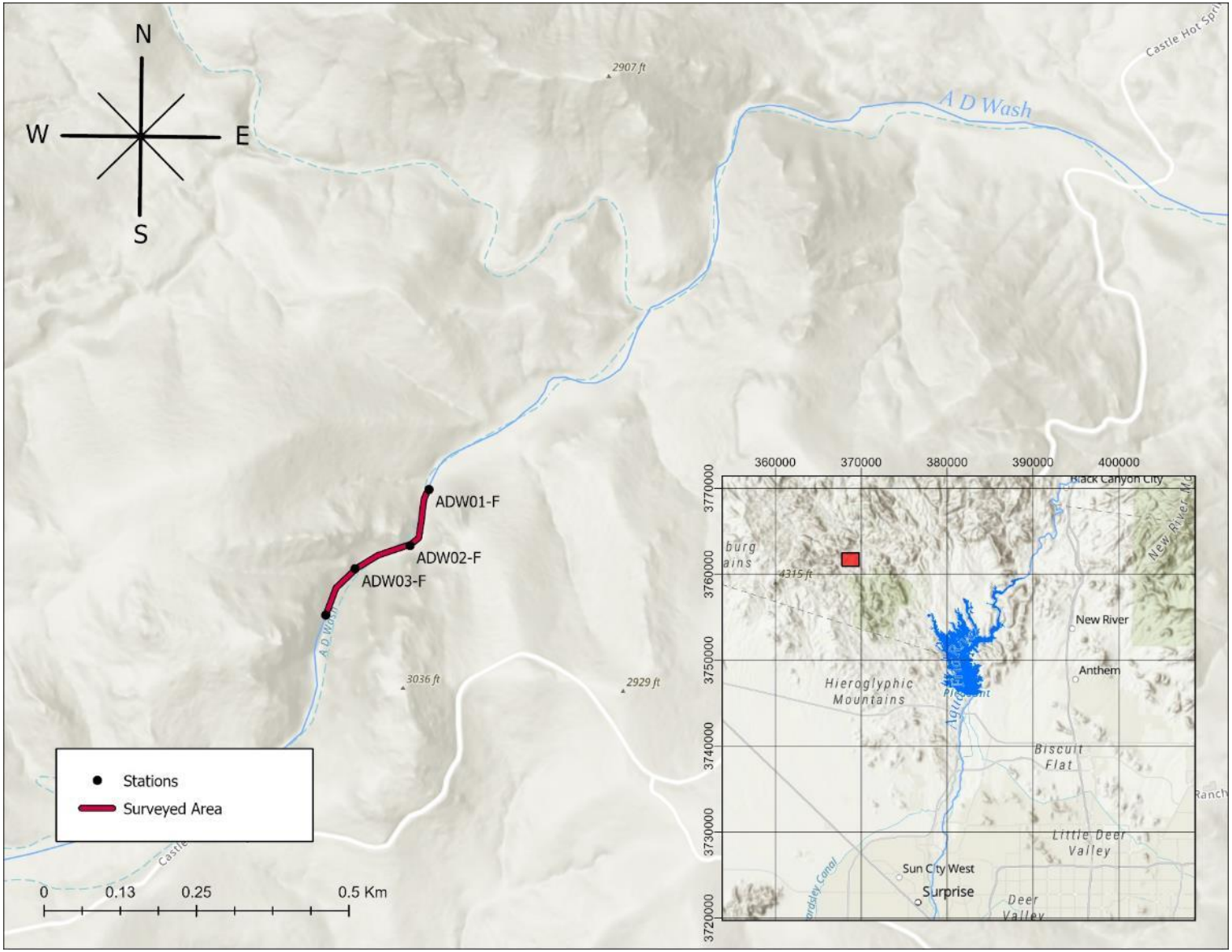

Figure 9. Location of stations sampled at AD Wash, Maricopa Co., Arizona, surveyed May 7, 2024.

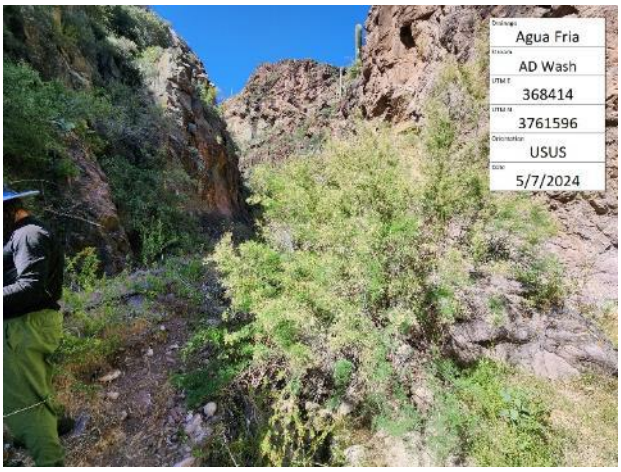

Figure 10. Upstream to upstream view of ADW03-F, AD Wash, Arizona.

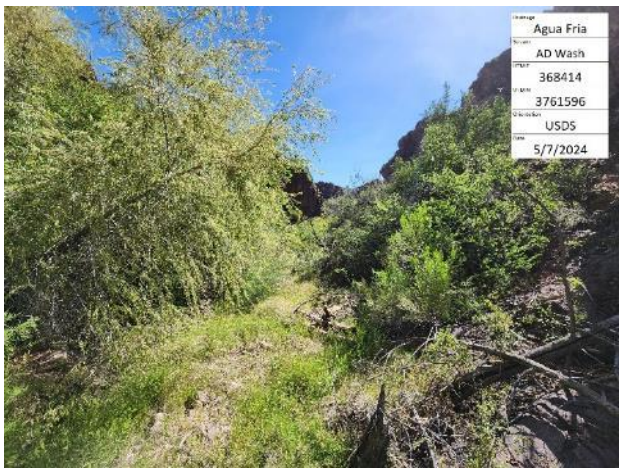

Figure 11. Upstream to downstream view of ADW03-F, AD Wash, Arizona.

Figure 12. Downstream to upstream view of ADW03-F, Upstream to upstream view of ADW02-F, AD Wash, Arizona.

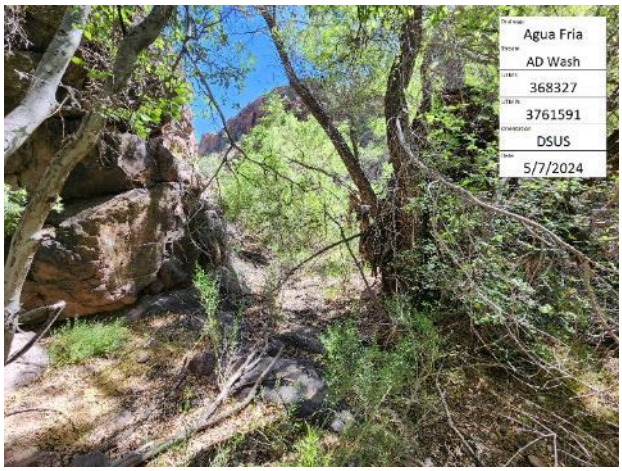

Figure 13. Downstream to downstream view of ADW03-F, Upstream to downstream view of ADW02-F, AD Wash, Arizona.

Figure 14. Downstream to upstream view of ADW02-F, upstream to upstream view of ADW01-F, AD Wash, Arizona.

Figure 15. Downstream to downstream view of ADW02-F, upstream to downstream view of ADW01-F, AD Wash, Arizona.

Figure 16. Downstream to upstream view of ADW01-F, AD Wash, Arizona.

Figure 17. Downstream to downstream view of ADW01-F, AD Wash, Arizona.

Buckhorn Spring May 20, 2024

Station		Lower Boundary	Upper Boundary
BHS01-F	12S NAD83	364316E, 3763820N	364334E, 3763724N
BHS02-F		364330E, 3763981N	364315E, 3763820N

Buckhorn Spring feeds into Buckhorn Creek, a tributary of Castle Creek that flows into the Agua Fria River at Lake Pleasant. The perennial section of Buckhorn Spring is about 300 m long and begins at an unnamed spring upstream of Buckhorn Spring. A fence surrounds 40-acres in the perennial portion of Buckhorn Spring to exclude burros and cattle. Gila Topminnow was initially stocked into Buckhorn Spring in 2011 and received supplemental stockings in 2013 and 2014 (Gray 2018). Gila Topminnow was the focal species at this site. The last surveys under the GRBNFMP were conducted in 2021 and 2019 and resulted in the capture of 99 and 74 Gila Topminnow, respectively (Shollenberger et al. 2022).

Buckhorn Spring was completed on May 20, 2024. Two fixed 100-m stations were surveyed beginning at 364330E/3763981N (Figure 18). Ten minnow traps were set in each station, baited with dry dog food, and set for a minimum of 2 hours. Both stations were immediately adjacent to each other and encompassed the entirety of the available surface water. Ten traps were set throughout this site and resulted in capture of nine unidentified tadpoles. Ten traps were set throughout the downstream station and captured a total of 69 unidentified tadpoles. The section of BHS02-F that extended downstream of the enclosure fence was dry.

The majority of the upstream station (BHS01-F) was dry, and water that was present was discolored and may have been unsuitable for fish. Average water temperature, dissolved oxygen, pH, and conductivity across the two fixed stations were 18.8 °C, 6.5 mg/L, 7.65, and 522 µS, respectively. Photographs of upper and lower extents of each fixed station are provided below (Figures 19-24).

In the previous survey, all Gila Topminnow captured (n=99) were in a pool just above the enclosure fence (Shollenberger et al. 2022). No fish were observed in said pool in 2024, and the most suitable habitat appeared to be in a deep pool immediately below the canyon where it narrows at the upper extent of BHS01-F. Bureau of Land Management (BLM) personnel surveyed Buckhorn Spring January 31, 2024. Personnel set eight minnow traps for 1.25 hours and did not report catching any fish.

A visit to this site next year is recommended to confirm the disappearance of Gila Topminnow at Buckhorn Spring considering no fish activity was noted in two recent surveys conducted by different agencies and personnel groups.

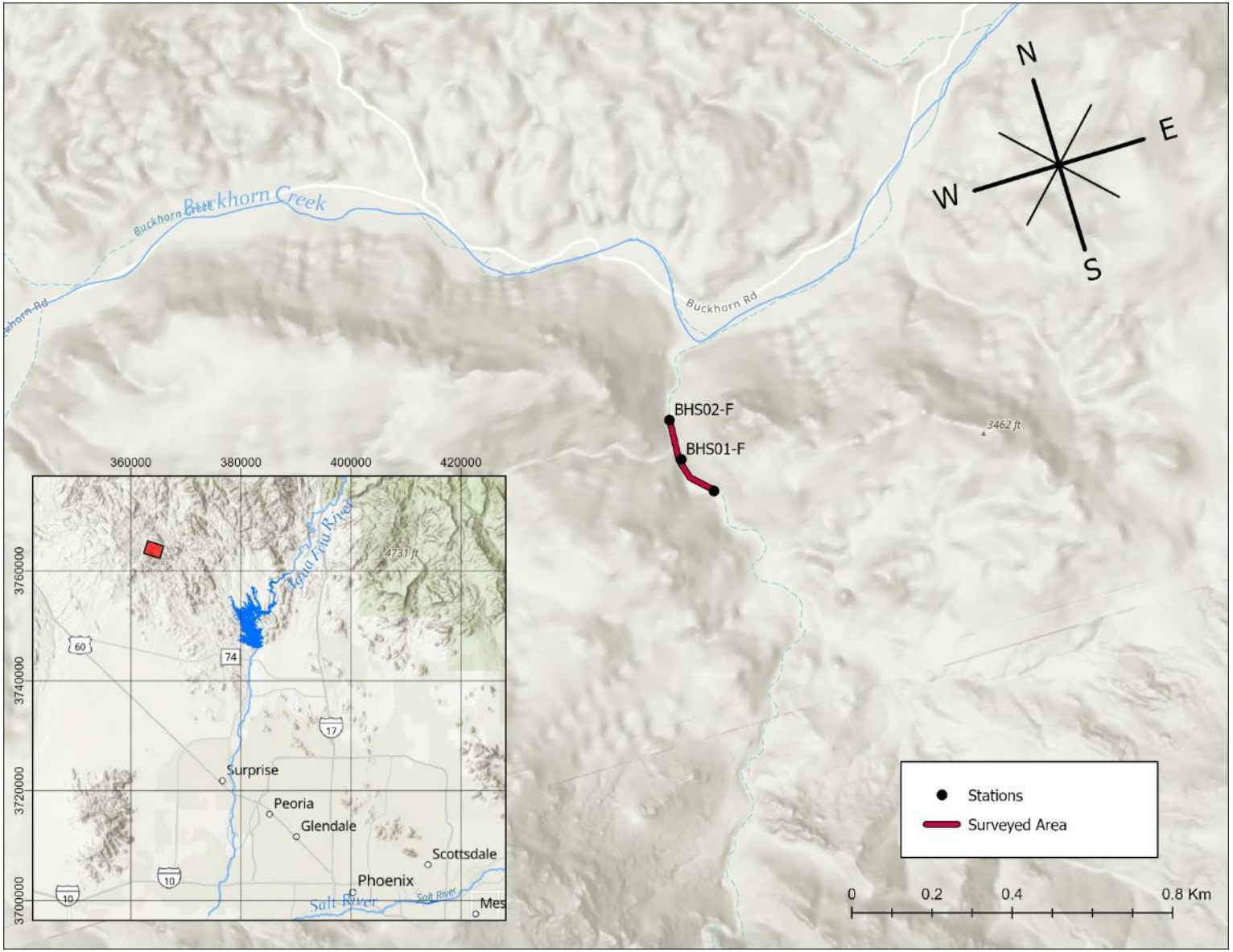

Figure 18. Location of sampled stations at Buckhorn Spring, Maricopa Co., Arizona, surveyed May 20, 2024.

Figure 19. Upstream to upstream view of BHS01-F, Buckhorn Spring, Arizona.

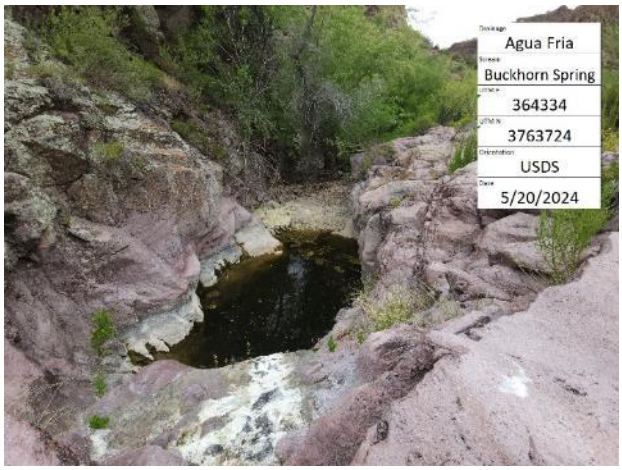

Figure 20. Upstream to downstream view of BHS01-F, Buckhorn Spring, Arizona.

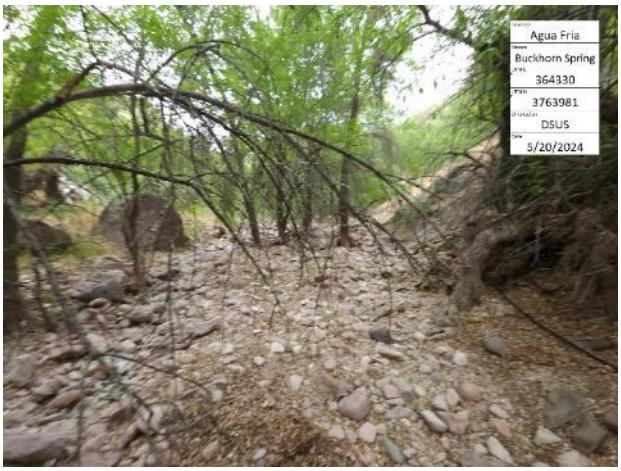

Figure 21. Downstream to upstream view of BHS02-F, Buckhorn Spring, Arizona.

Figure 22. Downstream to downstream view of BHS02-F, Buckhorn Spring, Arizona.

Figure 23. Downstream to upstream view of BHS01-F, upstream to upstream view of BHS02-F, Buckhorn Spring, Arizona.

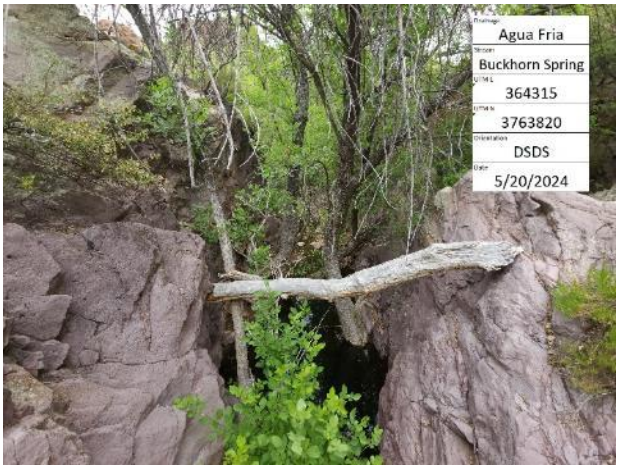

Figure 24. Downstream to downstream view of BHS01-F, upstream to downstream view of BHS02-F, Buckhorn Spring, Arizona.

Tule Creek May 21, 2024

Station		Lower Boundary	Upper Boundary
TLC01	12S NAD83	382515E, 3763677N	382469E, 3763748N
TLC03-F		382316E, 3763882N	382309E, 3763971N
TLC06		382295E, 3764066N	382265E, 3764150N

Tule Creek (Maricopa Co., AZ) is a tributary to Agua Fria River north of Lake Pleasant in the Bradshaw Mountains foothills. An 800-m stretch of perennial water exists 8.8 km upstream from the confluence. This section is protected by a 70-acre livestock enclosure. A fish barrier is present just upstream of the Lake Pleasant high-water mark to prevent movement of non-native fishes during periods of connectivity. Gila Topminnow (Monkey Spring lineage) was stocked into Tule Creek in 1981 and has persisted since. The focal species for this survey was Gila Topminnow. Tule Creek was last surveyed for GRBNFMP in 2019 and 2021, resulting in capture of 109 and 1,213 Gila Topminnow, respectively (Shollenberger et al. 2022).

M&A personnel surveyed Tule Creek on May 21, 2024. This site was accessed by parking near Old China Dam (12S 380292/ 3759906) and hiking approximately 6.5 km to Fort Tule Homestead Riparian Area. One fixed and two random stations were surveyed at Tule Creek (Figure 25).

Random stations TLC01 and TLC06 did not contain any sampleable habitat, so no effort was expended. The uppermost station was entrenched with cattails and no surface water was found and the most downstream station was dry. Ten traps were set throughout fixed station TLC03-F for approximately 2 hours. A total of 680 Gila Topminnow was captured. This station encompassed the entirety of suitable habitat present for Gila Topminnow throughout the perennial extent. Only two small pools, 1.6 and 0.3 m deep, contained a high concentration of Gila Topminnow within the entirety of the survey extent. Catch and effort totals are summarized in Table 5.

Water temperature, dissolved oxygen, pH, and conductivity at the fixed station were recorded at 19.2°C, 5.6 mg/L, 7.37, and 1,753 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 26-29).

It has been noted in past GRBMP surveys that available habitat has been declining due to cattail and sedge growth (Timmons and Paulus 2016). This trend is continuing, as pools had little open water and were choked with cattails. While catch totals this year were high, the outlook at this site appears poor unless corrective action is taken. Suitable habitat is dwindling due to encroachment of emergent aquatic vegetation. This is leading to a decrease in open water habitat and water quality.

Table 5. Catch summary table of fish captured at Tule Creek, Maricopa Co., Arizona on May 21, 2024. Total effort was 20.1 trap hours.

Stations	Statistic	POOC <20	POOC >=20	Totals
TLC03-F (20.1 hrs)	Count	70	610	680
	% total catch	10.29%	89.71%	100.00%
	CPUE (ind/hr)	3.49	30.38	33.86

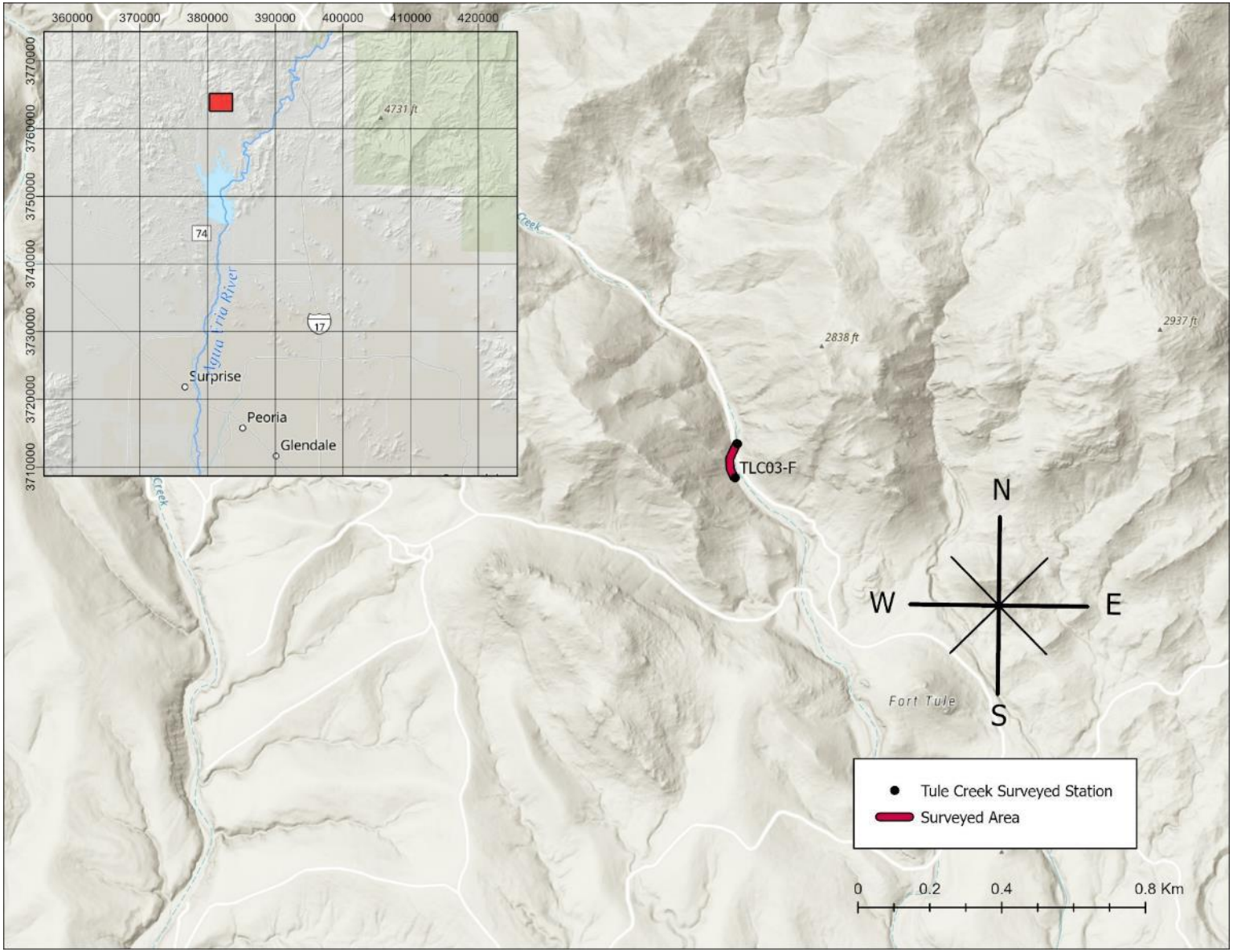

Figure 25. Location of sampled stations at Tule Creek, Maricopa Co., Arizona, surveyed May 21, 2024.

Figure 26. Upstream to upstream view of TLC03-F, Tule Creek, Arizona.

Figure 27. Upstream to downstream view of TLC03-F, Tule Creek, Arizona.

Figure 28. Downstream to upstream view of TLC03-F, Tule Creek, Arizona.

Figure 29. Downstream to downstream view of TLC03-F, Tule Creek, Arizona.

San Pedro River Basin

Hot Springs Canyon September 16 – 18, 2024

Station		Lower Boundary	Upper Boundary
HSC01	12S NAD83	569720E, 3579832N	569804E, 3579859N
HSC04		569508E, 3579983N	569594E, 3579972N
HSC06-F		569339E, 3579980N	569420E, 3579935N
HSC11		569004E, 3579900N	567070E, 3579982N
HSC20		568343E, 3580100N	568441E, 3580132N
HSC23-F		568081E, 3580062N	568184E, 3580085N
HSC27		567954E, 3580020N	567966E, 3579922N
HSC28		567923E, 3580106N	567954E, 3580020N
HSC32-F		567646E, 3580043N	567739E, 3580057N

Hot Springs Canyon (Cochise Co., AZ) originates from western slopes of Winchester Mountains and is tributary to San Pedro River. A 3.4-km section of perennial stream is located within TNC's Muleshoe Ranch property. Hot Springs Canyon is protected from invasion by non-native species by a concrete fish barrier located 9 km upstream from the San Pedro confluence. Loach Minnow and Spikedace were stocked into Hot Springs Canyon every year from 2007-2011. Loach Minnow is considered established in Hot Springs Canyon as evidence of recruitment has been found every year since the last stocking. It is unclear if Spikedace was established as annual monitoring efforts have noted a steady decrease in numbers since 2012 and recruitment has not been detected every year. These populations were augmented with 300 Loach Minnow and 333 Spikedace in May 2020 near the confluence with Wildcat Canyon (Hickerson et al. 2021). Gila Chub, Loach Minnow, and Spikedace were the focal species for Hot Springs Canyon. Hot Springs Canyon monitoring efforts have been conducted annually since 2011 and 150 Gila Chub, 25 Loach Minnow, and no Spikedace were captured during the most recent survey in 2023 (Reap et al. 2024).

M&A personnel completed monitoring of Hot Springs Canyon September 16-18, 2024. Sampling was completed by BPEF with dip nets. Nine, 100-m stations were sampled throughout reaches 1-3 in Hot Springs Canyon (Figure 30). One fixed and two randomly selected stations were sampled in each reach. Stations were accessed by hiking downstream from Muleshoe Ranch Headquarters.

Totals of 43 Loach Minnow, 102 Gila Chub, 1,168 Longfin Dace, 1,158 Speckled Dace, 137 Desert Sucker, and 17 Sonora Sucker were captured across all nine stations. Catch and effort totals are summarized by reach below (Table 6). No non-native species were captured or observed. Loach Minnow were detected at four of nine stations and were most abundant near the confluence with Wildcat Canyon. Gila Chub were detected at five of nine stations. Spikedace were not captured during annual monitoring for the fifth consecutive year. Spikedace were last detected during autumn monitoring in 2019 when two individuals were captured (Hickerson et al. 2020). Loach Minnow catch was similar to recent survey years, but this year's totals were the most since 2019 when personnel captured 50 individuals. Length-frequency histograms for Gila Chub and Loach Minnow captured at Hot Springs Canyon are included

below (Figures 32 and 33). CPUE trends for each focal species across a 10-year period are included in Figure 31. Data from 2012-2019 were collected by AZGFD and provided by Reclamation.

Water availability was noticeably low this year compared to recent surveys. Average discharge at Hot Springs Canyon from years 2021 – 2024 was 1.76, 3.88, 0.43 and 0.28 cfs, respectively. Monsoonal activity from the day prior to sampling caused slight turbidity at the most downstream stations. Substrate of loose cobble was consistent throughout all reaches. Average stream discharge across two fixed stations was calculated to be 0.008 m^3/s (0.28 cfs). Average water temperature, DO, pH, and conductivity across three fixed stations was 22.4 °C, 11.56 mg/L, 7.73, and 578 µS, respectively. Photographs of upper and lower extents of each fixed station are provided below (Figures 34-45). Dissolved oxygen was noticeably lower in the most downstream fixed station HSC32-F and was recorded at 4.3 mg/L, whereas the upstream fixed stations (HSC06-F and HSC23-F) were recorded at 13.0 and 17.4 mg/L, respectively.

Despite Loach Minnow catch being low, the number of individuals caught year-to-year was not significantly different. However, Loach Minnow CPUE in 2024, 31.29 individuals/hour(ind/hr), increased from last year's CPUE of 8.04 ind/hr. It was hypothesized in last year's annual report after reviewing length-frequency histograms of sampled Loach Minnow, the population appeared to have years of larger fish, followed by a year of smaller fish, and thirdly a year of evenly distributed size. The data derived from this year does not support that observation. Loach Minnow catch appeared to peak around the confluence with Wildcat Canyon. Gila Chub CPUE varied from year to year seemingly dependent on habitat availability with the exception of this year. Although habitat did not favor Gila Chub this year, effort in electrofishing seconds decreased significantly from last year (11,198 seconds), which inflated CPUE. Sampling efforts were unsuccessful at capturing Spikedace, despite relatively recent stocking events.

Table 6. Catch table of fish captured at Hot Springs Canyon, Cochise Co., Arizona, surveyed September 16-18, 2024. Total effort was 4,948 seconds.

Reach	Stations	Statistic	AGCH	CAIN	GIIN	PACL	TICO	RHOS	Totals
1 (1,148 sec)	HSC01 HSC04 HSC06-F	Count	741	9	87	90	12	740	1,679
		% total catch	44.13%	0.54%	5.18%	5.36%	0.71%	44.07%	100.00%
		CPUE (ind/hr)	2323.69	28.22	272.82	282.23	37.63	2320.56	5265.16
2 (1,869 sec)	HSC11 HSC20 HSC23-F	Count	293	8	15	43	30	385	774
		% total catch	37.86%	1.03%	1.94%	5.56%	3.88%	49.74%	100.00%
		CPUE (ind/hr)	564.37	15.41	28.89	82.83	57.78	741.57	1490.85
3 (1,931 sec)	HSC27 HSC28 HSC32-F	Count	134	0	0	4	1	33	172
		% total catch	77.91%	0.00%	0.00%	2.33%	0.58%	19.19%	100.00%
		CPUE (ind/hr)	249.82	0.00	0.00	7.46	1.86	61.52	320.66
Total		Count	1,168	17	102	137	43	1,158	2,625
		% total catch	44.50%	0.65%	3.89%	5.22%	1.64%	44.11%	100.00%
		CPUE (ind/hr)	849.80	12.37	74.21	99.68	31.29	842.52	1909.86

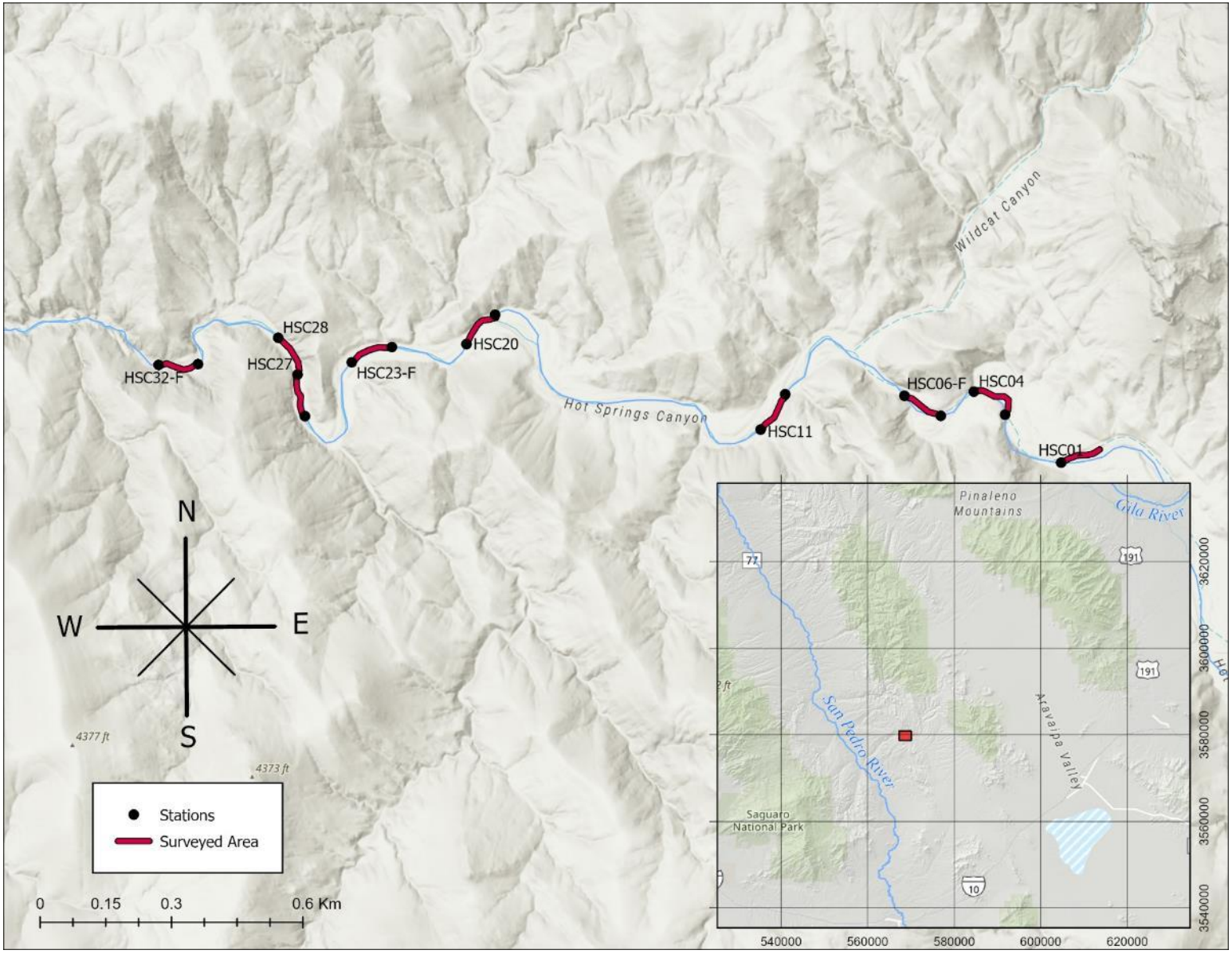

Figure 30. Location of sampled stations at Hot Springs Canyon, Cochise Co., Arizona, surveyed September 16 – 18, 2024.

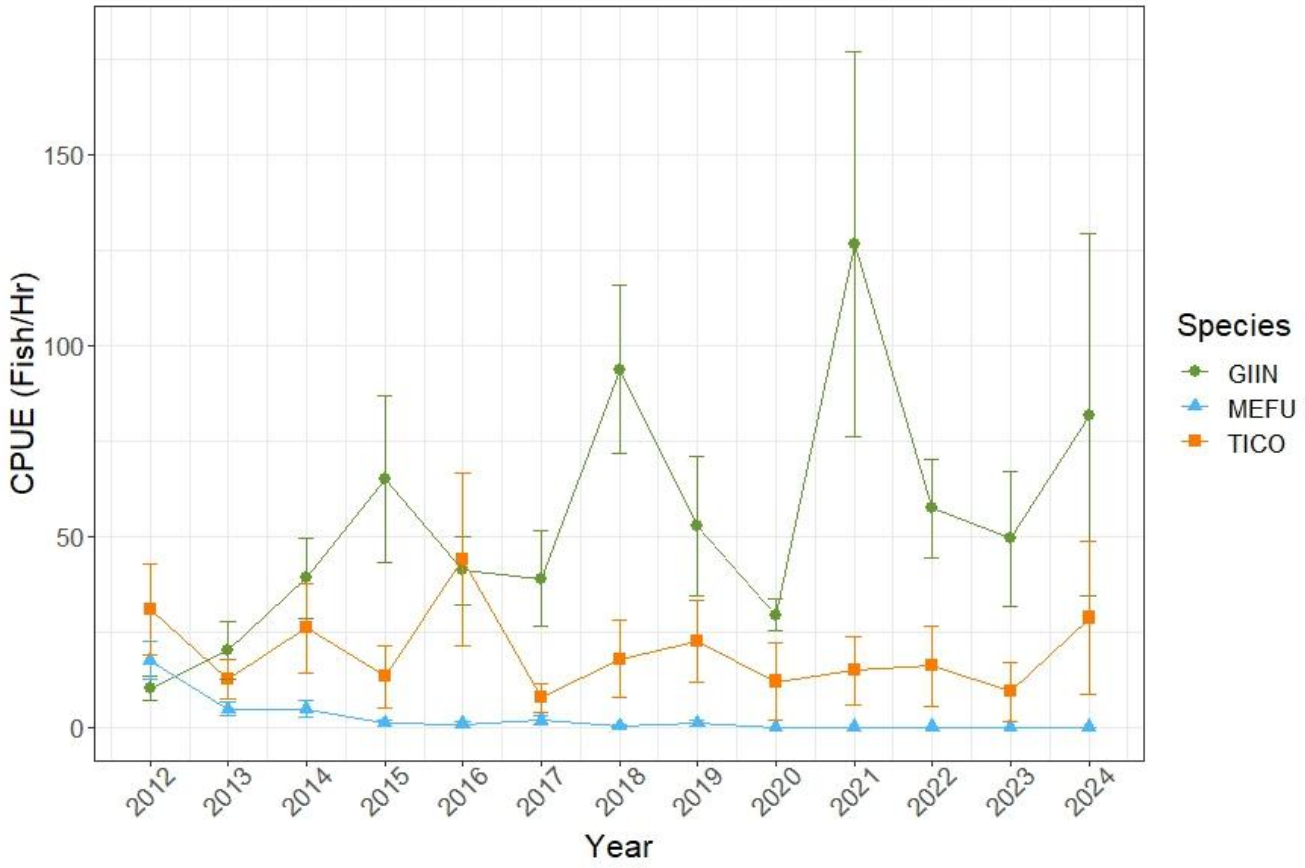

Figure 31. Mean CPUE trend of Gila Chub, Loach Minnow, and Spikedace at Hot Springs Canyon, Maricopa Co., Arizona, 2012-2024.

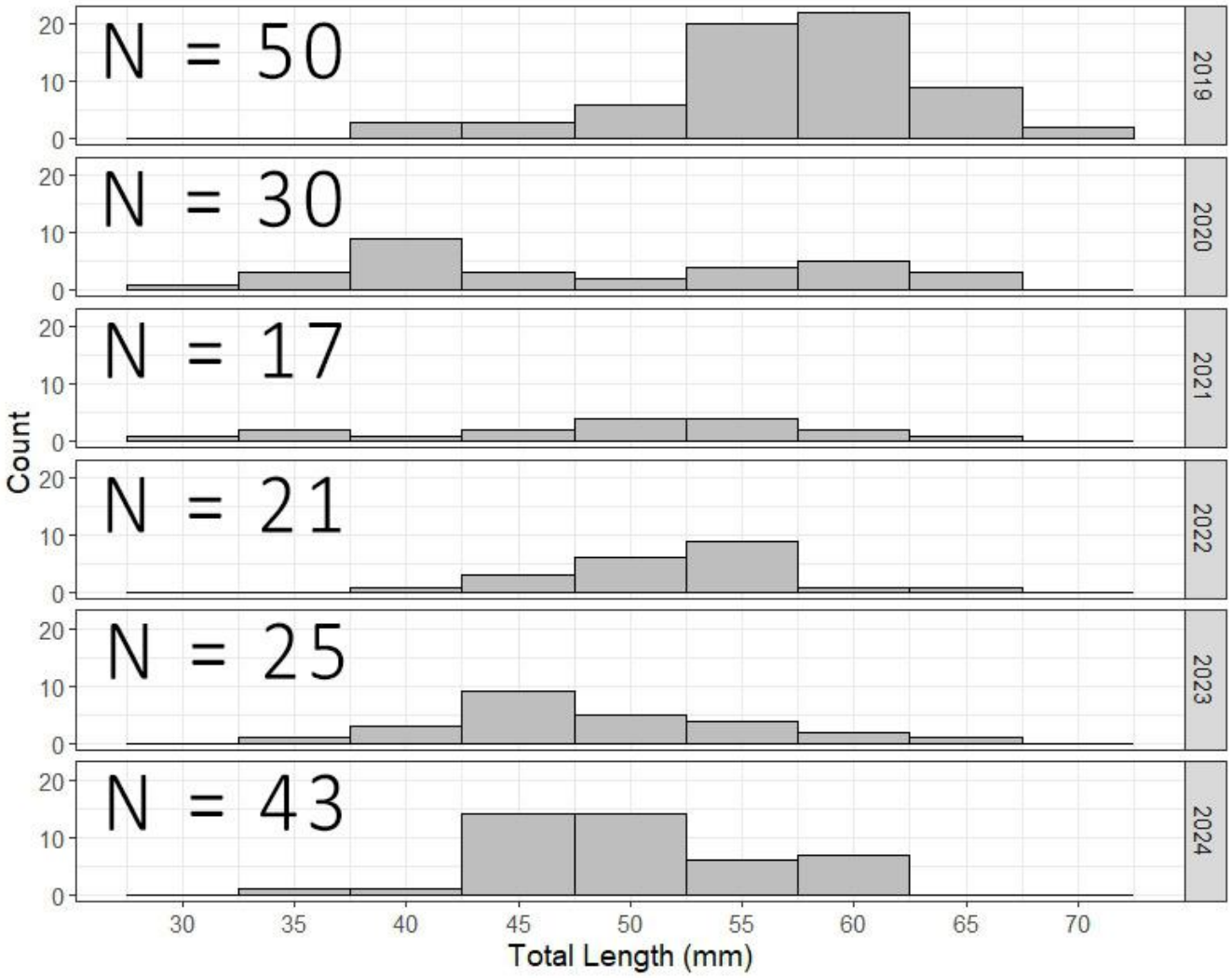

Figure 32. Length-Frequency histogram of Loach Minnow captured at Hot Springs Canyon, Cochise Co., Arizona, 2019-2024. Total number of Loach Minnow caught is denoted in the top left of each survey year.

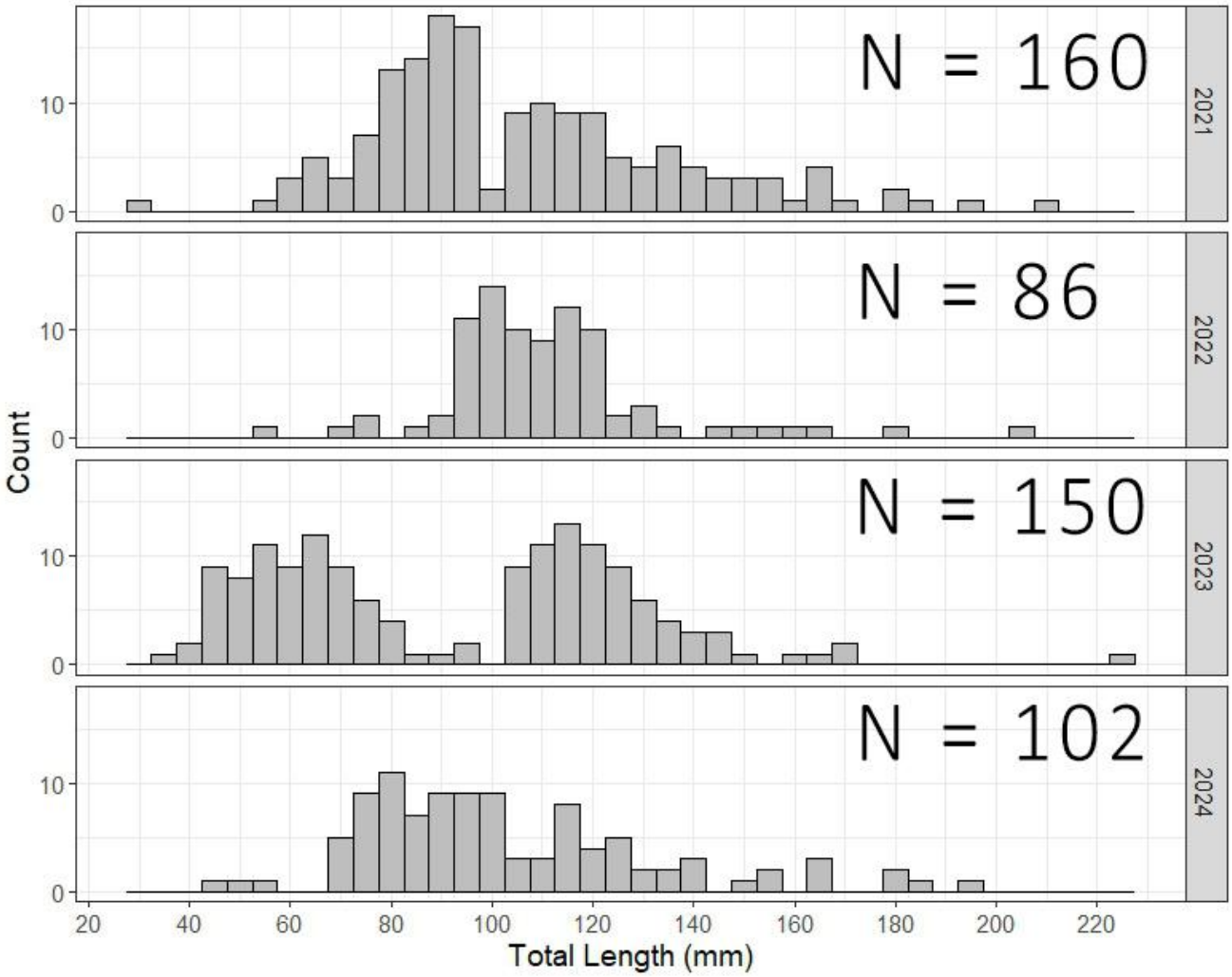

Figure 33. Length-Frequency histogram of Gila Chub captured at Hot Springs Canyon, Arizona, 2021-2024. Total number of Gila Chub caught per survey year is denoted in the top right.

Figure 34. Downstream to downstream view of HSC06-F, Hot Springs Canyon, Arizona.

Figure 35. Downstream to upstream view of HSC06-F, Hot Springs Canyon, Arizona.

Figure 36. Upstream to downstream view of HSC06-F, Hot Springs Canyon, Arizona.

Figure 37. Upstream to upstream view of HSC06-F, Hot Springs Canyon, Arizona.

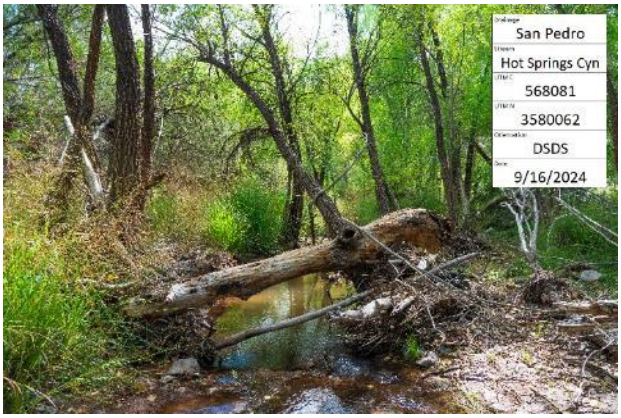

Figure 38. Downstream to downstream view of HSC23-F, Hot Springs Canyon, Arizona.

Figure 39. Downstream to upstream view of HSC23-F, Hot Springs Canyon, Arizona.

Figure 40. Upstream to downstream view of HSC23-F, Hot Springs Canyon, Arizona.

Figure 41. Upstream to upstream view of HSC23-F, Hot Springs Canyon, Arizona.

Figure 42. Downstream to downstream view of HSC32-F, Hot Springs Canyon, Arizona.

Figure 43. Downstream to upstream view of HSC32-F, Hot Springs Canyon, Arizona.

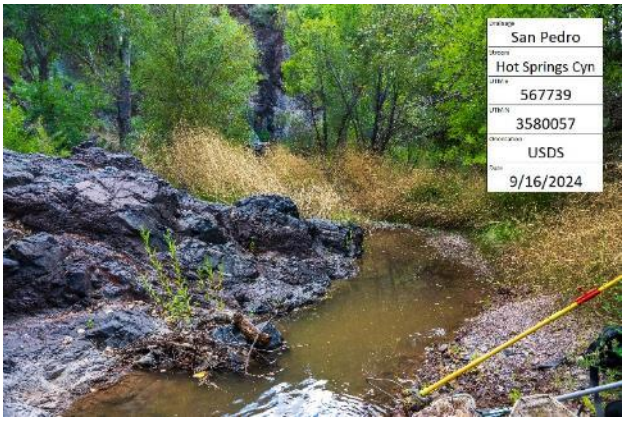

Figure 44. Upstream to downstream view of HSC32-F, Hot Springs Canyon Arizona.

Figure 45. Upstream to upstream view of HSC32-F, Hot Springs Canyon, Arizona.

Bass Canyon September 17, 2024

Station		Lower Boundary	Upper Boundary
BSC12	12S NAD83	572560E, 3580306N	572537E, 3580392N
BSC14		572362E, 3580262N	572467E, 3580287N
BSC24-F		571944E, 3579651N	572005E, 3579691N
BSC26		571090E, 3579714N	571125E, 3579662N
BSC30		570838E, 3579683N	570850E, 3579784N

Bass Canyon (Cochise Co., AZ) is a tributary to Hot Springs Canyon within the Muleshoe Ranch Cooperative Management Area (CMA) in the San Pedro sub-basin. There is 1.6 km of perennial water upstream of the FSR-691 road crossing and a separate 300-m section downstream of the road. Gila Topminnow (Bylas Spring lineage) was stocked into Bass Canyon in 2014, with supplemental stockings in 2015 and 2016 (Gray 2018). The Gila Topminnow population in Bass Canyon is now considered established (B. Hickerson, personal communication, September 1, 2021). The focal species at Bass Canyon were Gila Chub and Gila Topminnow. Bass Canyon was last surveyed for Gila Chub as part of GRBMP in 2021, resulting in capture of 76 Gila Chub and 17 Gila Topminnow (Shollenberger et al. 2022).

M&A personnel completed sampling of Bass Canyon on September 17, 2024. Sampling at Bass Canyon was completed with a combination of minnow traps and BPEF. One fixed and four random stations were sampled in Bass Canyon (Figure 46). All stations were accessed by hiking up and downstream from FSR-691. BPEF was conducted at all five stations to target Gila Chub. Electrofishing effectiveness was limited due to the depth of pools at the time of this survey. Minnow traps were set following completion of BPEF survey at stations BSC24-F, BSC26, and BSC30 to target Gila Topminnow. Due to this approach, minnow trap catch totals are interpreted as a separate survey because double sampling could have occurred.

Across five stations, totals of 287 Gila Chub, 139 Speckled Dace, 96 Sonora Sucker, 15 Desert Sucker, and 10 Longfin Dace were captured via BPEF (Table 7). In the three most downstream stations, totals of 381 Gila Chub, 25 Speckled Dace, 1 Sonora Sucker and 1 Lowland Leopard Frog *Rana yavapaiensis* metamorph were captured via Minnow Trap (Table 8). Gila Topminnow were not captured or observed in this survey. In 2021, 17 Gila Topminnow were captured and a majority (n=15) of catch occurred in the fixed station (BSC24-F).

Stream discharge was measured at the downstream boundary of BSC24-F and calculated to be 0.006 m3/s (0.22 cfs). Water temperature, dissolved oxygen, pH, and conductivity measured at the fixed station were 21.5 °C, 6.8 mg/L, 7.57, and 375 µS, respectively. A length-frequency histogram for all Gila Chub captured at Bass Canyon is included below (Figure 47). Photographs of upper and lower extents of the fixed station are provided below (Figures 48-51). A notable Gila Chub with blue coloration was documented and provided in figure 52.

Table 7. Catch table of fish captured at Bass Canyon, Cochise Co., Arizona, surveyed September 17, 2024. Total effort was 3,314 seconds.

Station	Statistic	GIIN	AGCH	RHOS	CAIN	PACL	Total
BSC12 (798sec)	Count	39	1	23	39	3	105
	% total catch	37.14%	0.95%	21.90%	37.14%	2.86%	100.00%
	CPUE (ind/hr)	175.94	4.51	103.76	175.94	13.53	473.68
BSC14 (933 sec)	Count	66	8	62	33	7	176
	% total catch	37.50%	4.55%	35.23%	18.75%	3.98%	100.00%
	CPUE (ind/hr)	254.66	30.87	239.23	127.33	27.01	679.10
BSC24 - F (624 sec)	Count	65	1	21	12	0	99
	% total catch	65.66%	1.01%	21.21%	12.12%	0.00%	100.00%
	CPUE (ind/hr)	375	6	121	69	0	571
BSC26 (189 sec)	Count	40	0	0	2	1	43
	% total catch	93.02%	0.00%	0.00%	4.65%	2.33%	100.00%
	CPUE (ind/hr)	761.90	0.00	0.00	38.10	19.05	819.05
BSC30 (770 sec)	Count	77	0	33	10	4	124
	% total catch	62.10%	0.00%	26.61%	8.06%	3.23%	100.00%
	CPUE (ind/hr)	360	0	154.29	46.75	18.70	579.74
Total	Count	287	10	139	96	15	547
	% total catch	52.47%	1.83%	25.41%	17.55%	2.74%	100.00%
	CPUE (ind/hr)	311.77	10.86	151.00	104.28	16.29	594.21

Table 8. Summary of catch by minnow trap at three stations at Bass Canyon, Cochise Co., Arizona, surveyed on September 17, 2024. Total effort was 170.23 hours.

Station	Statistic	CAIN	GIIN	RAYA	RHOS	Total
BSC24 - F (33.73 hrs)	Count	0	69	0	13	82
	% total catch	0.00%	84.15%	0.00%	15.85%	100.00%
	CPUE (ind/hr)	0.00	2.05	0.00	0.39	2.43
BSC26 (66.20 hrs)	Count	1	198	0	7	206
	% total catch	0.49%	96.12%	0.00%	3.40%	100.00%
	CPUE (ind/hr)	0.02	2.99	0.00	0.11	3.11
BSC30 (70.29 hrs)	Count	0	114	1	5	120
	% total catch	0.00%	95.00%	0.83%	4.17%	100.00%
	CPUE (ind/hr)	0.00	1.62	0.01	0.07	1.71
Total	Count	1	381	1	25	408
	% total catch	0.25%	93.38%	0.25%	6.13%	100.00%
	CPUE (ind/hr)	0.01	2.24	0.01	0.15	2.40

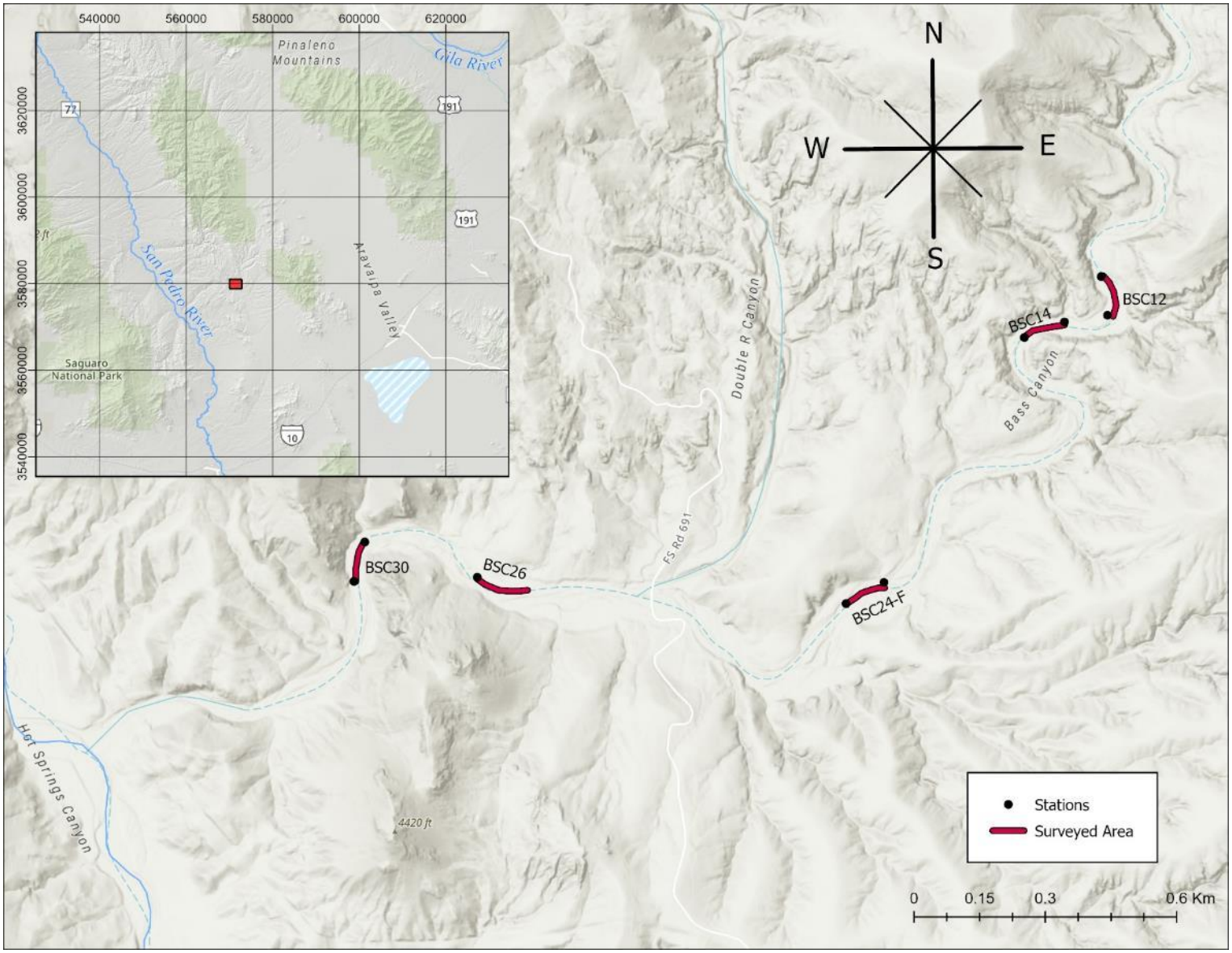

Figure 46. Location of sampled stations at Bass Canyon, Cochise Co., Arizona, surveyed September 17, 2024.

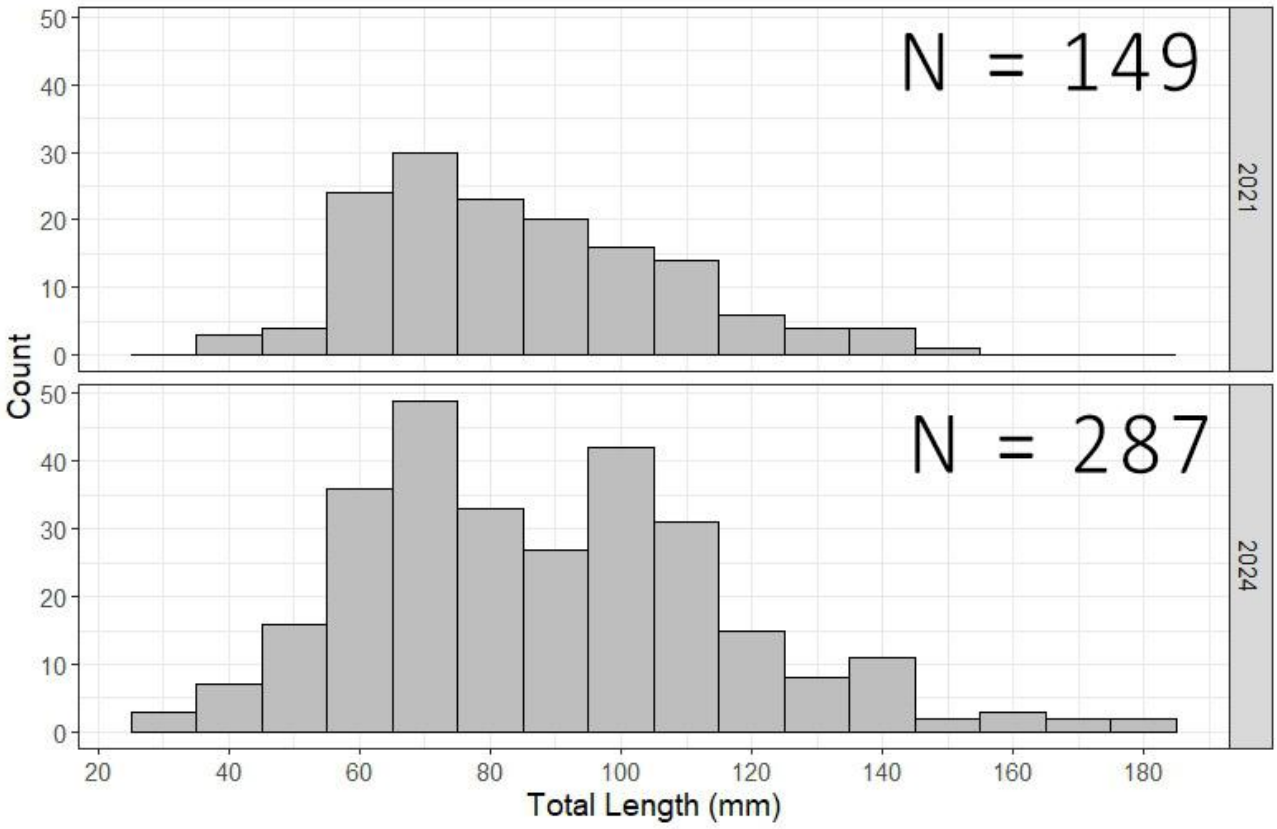

Figure 47. Length-frequency histogram of Gila Chub captured at Bass Canyon, Cochise Co., Arizona, via BPEF, in survey years 2021 and 2024.

Figure 48. Downstream to downstream view of BSC24-F, Bass Canyon Arizona.

Figure 49. Downstream to upstream view of BSC24-F, Bass Canyon Arizona.

Figure 50. Upstream to downstream view of BSC24-F, Bass Canyon Arizona.

Figure 51. Upstream to upstream view of BSC24-F, Bass Canyon Arizona.

Figure 52. Gila Chub captured at Bass Canyon, Arizona.

Santa Cruz River Basin

Coal Mine Canyon April 9, 2024

Station		Lower Boundary	Upper Boundary
CMC01-F	12R NAD83	510442E, 3487943N	510512E, 3488016N
CMC02-F		510053E, 3487035N	510035E, 3487135N

Coal Mine Canyon (Cochise Co., AZ) is tributary to Fresno Canyon in Sonoita Creek drainage and is located north of Patagonia Lake State Park. The natural population of Gila Topminnow was first discovered in Coal Mine Canyon in 1996 (Weedman 1999). This site is surveyed annually for GRBNFMP. Gila Topminnow was the focal species at Coal Mine Canyon. In the two most recent surveys 1,033 (2022) and 880 (2023) Gila Topminnow were captured across both stations (Reap et al. 2024).

M&A personnel surveyed Coal Mine Canyon on April 9-10, 2024. This site was accessed via Blue Haven Road in Patagonia, AZ, which was followed to Solero Ranch Road, and then Montezuma Well Road was taken to the fenced Coal Mine Spring where the vehicle was parked. A private landowner gate was present near the start of Montezuma Well Road and required a gate code to proceed on the road. Access to this location also required coordination with Arizona State Parks to acquire a permit to conduct scientific sampling in this area. Two, 100-m fixed stations were surveyed, with each station encompassing one of the perennial pools (Figure 53). Both stations were sampled with 10 minnow traps for approximately two hours.

The upstream station, CMC01-F, was located at a large, fenced spring pool. This pool was approximately 17-m long and 20-m wide; last year this pool was 16-m long and 18-m wide. Water levels were higher compared to 2023 and 2022. In addition, the rest of the station was wetted whereas in past surveys it was dry. Totals of 136 Gila Topminnow and 13 Northern Crayfish *Faxonius virilis* were captured (Table 9).

The second station, CMC02-F, was located approximately 1 km downstream from CMC01-F. This station consisted of a single pool about 22-m in length, 8-m wide, and 2-m deep, similar to conditions encountered in the last survey. The entirety of the station was wetted this year, similar to conditions noted in 2023. Totals of 163 Gila Topminnow, 113 Longfin Dace, and eight American Bullfrog *Rana catesbeiana* tadpoles were captured. Three adult American Bullfrogs were captured via dip net in 2023's survey. No adults were observed in 2024, but 50-75 tadpoles were observed where personnel could see to the bottom of the pool.

Average water temperature, DO, pH, and conductivity across the two fixed stations was 18.1 °C, 7.8 mg/L, 8.28, and 230 µS, respectively. Photographs of upper and lower extents of each fixed station are provided below (Figures 55-62).

Mean CPUE for Gila Topminnow at this site was greater compared to last year (Figure 54). Minnow traps only sample the very edges of the large spring pool. Surface water conditions continue to improve across both perennial pools as well as in between stations. This year, Gila Topminnow were observed in rock pools between spring stations that were dry or were fishless in previous years.

Table 9. Summary of catch by minnow trap for two stations sampled at Coal Mine Canyon, Santa Cruz Co., Arizona, April 9-10, 2024. Total effort was 42.0 hours.

Stations	Statistic	POOC <20	POOC ≥20	AGCH <40	AGCH ≥40	FAVI	RANA	Totals
CMC01-F (20.8 hrs)	Count	47	89	0	0	13	0	149
	% total catch	31.54%	59.73%	0.00%	0.00%	8.72%	0.00%	100.00%
	CPUE (ind/hr)	2.25	4.27	0.00	0.00	0.62	0.00	7.14
CMC02-F (21.2 hrs)	Count	134	29	1	112	0	8	284
	% total catch	47.18%	10.21%	0.35%	39.44%	0.00%	2.82%	100.00%
	CPUE (ind/hr)	6.33	1.37	0.05	5.29	0.00	0.38	13.41
	Count	181	118	1	112	13	8	433
	% total catch	41.80%	27.25%	0.23%	25.87%	3.00%	1.85%	100.00%
	CPUE (ind/hr)	4.31	2.81	0.02	2.66	0.31	0.19	10.30

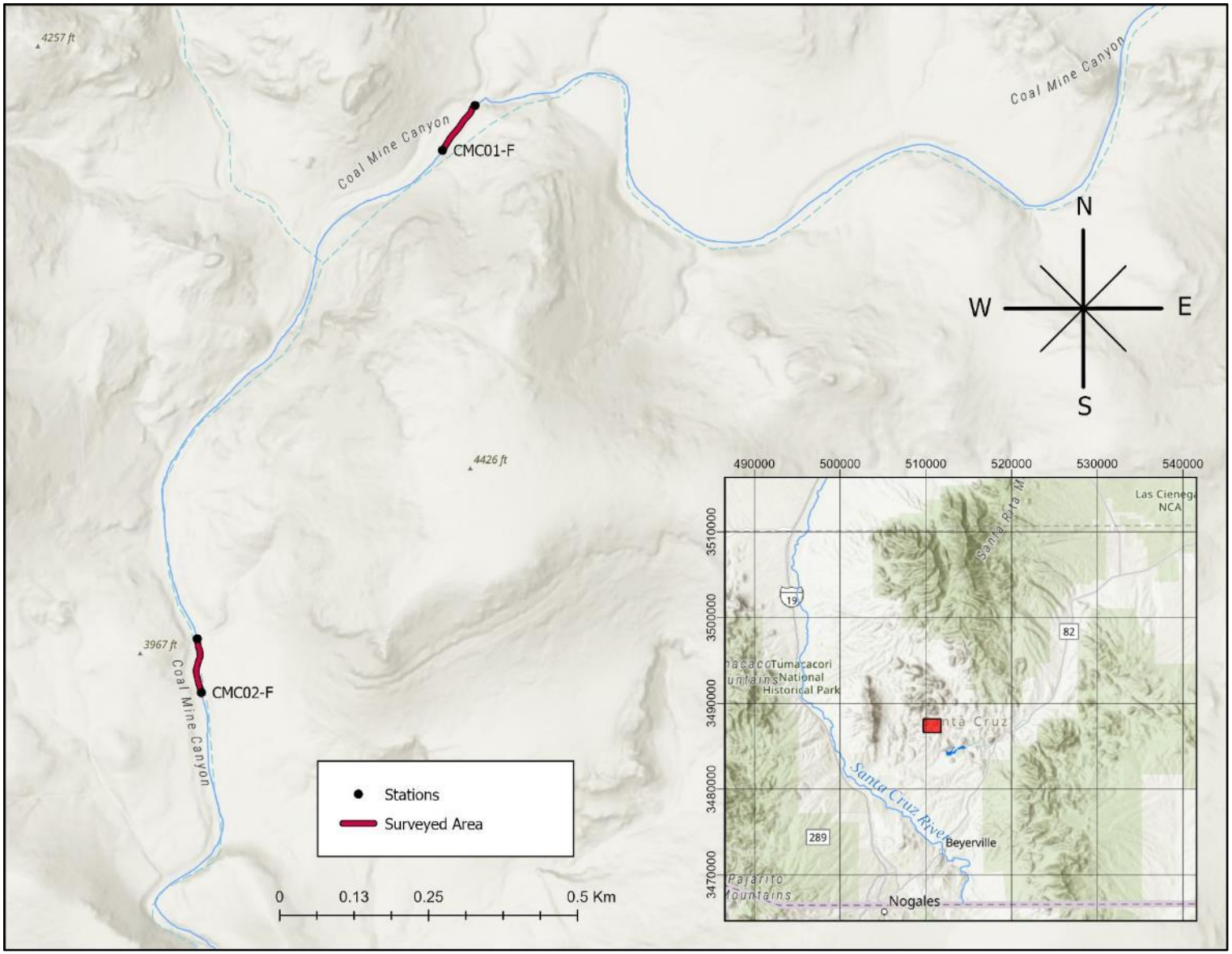

Figure 53. Location of sampled stations at Coal Mine Canyon, Santa Cruz Co., Arizona, surveyed April 9-10, 2024.

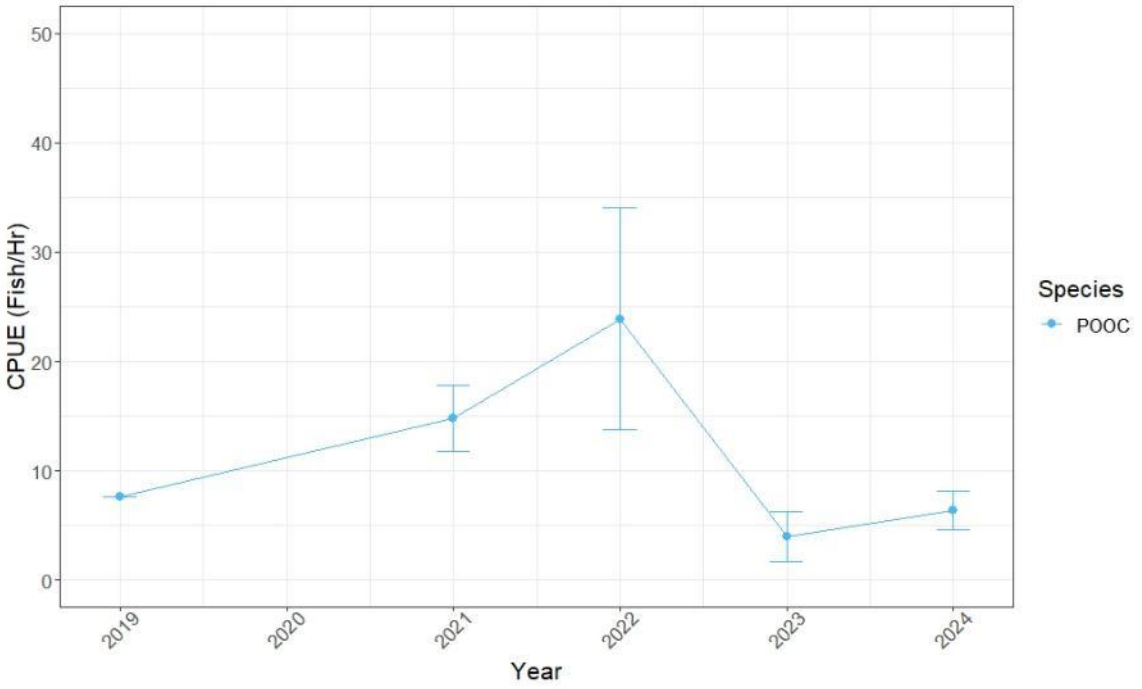

Figure 54. CPUE of Gila Topminnow captured at Coal Mine Canyon, Santa Cruz Co., Arizona, by minnow trap, 2019-2024.

Figure 55. Upstream to upstream view of CMC01-F, Coal Mine Canyon, Arizona.

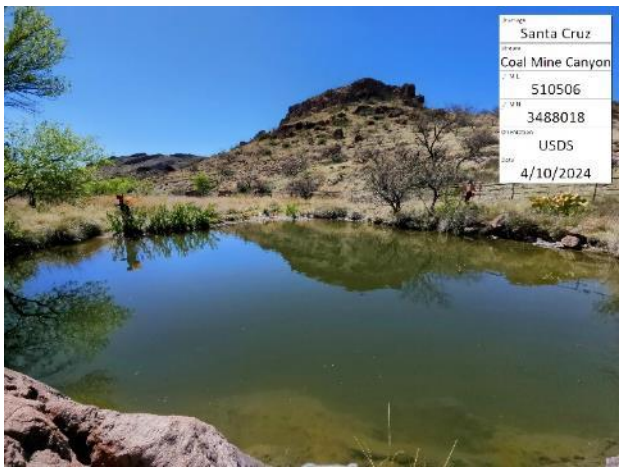

Figure 56. Upstream to downstream view of CMC01-F, Coal Mine Canyon, Arizona.

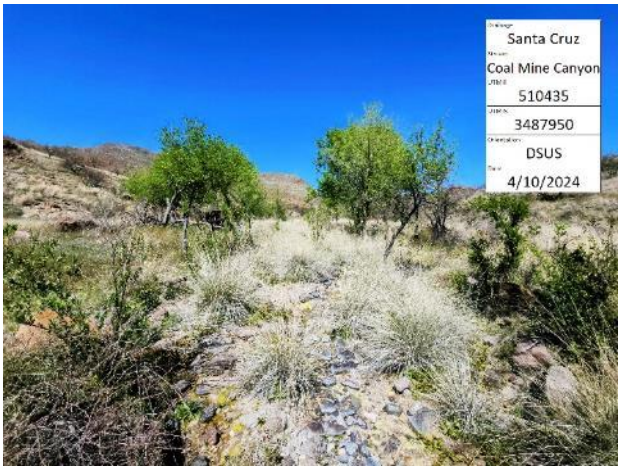

Figure 57. Downstream to upstream view of CMC01-F, Coal Mine Canyon, Arizona.

Figure 58. Downstream to downstream view of CMC01-F, Coal Mine Canyon, Arizona.

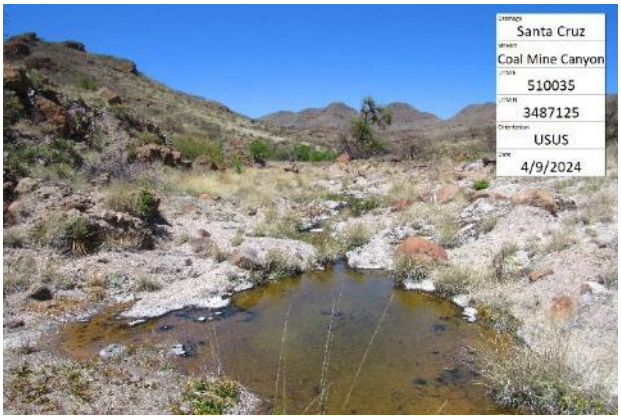

Figure 59. Upstream to upstream view of CMC02-F, Coal Mine Canyon, Arizona.

Figure 60. Upstream to downstream view of CMC02-F, Coal Mine Canyon, Arizona.

Figure 61. Downstream to downstream view of CMC02-F, Coal Mine Canyon, Arizona.

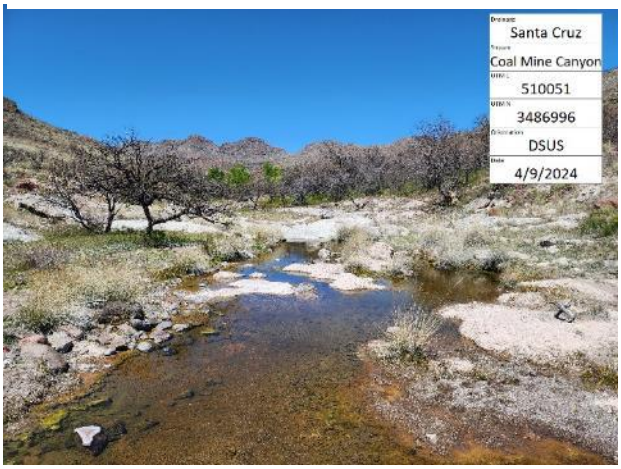

Figure 62. Downstream to upstream view of CMC02-F, Coal Mine Canyon, Arizona.

Cottonwood Spring April 9, 2024

Station		Lower Boundary	Upper Boundary
CWS01-F	12R NAD83	527493E, 3502122N	527554E, 3502055N

Cottonwood Spring (Santa Cruz Co., AZ) is tributary to Sonoita Creek located between the towns of Patagonia and Sonoita. The entire length of stream is approximately 100-m; however, the majority of 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. The focal species for this site was Gila Topminnow. A small but stable natural population of Gila Topminnow is present in Cottonwood Spring and sometimes occupies pools in Sonoita Creek when habitat is available (Weedman 1999). Cottonwood Spring was last surveyed for this monitoring program in 2022 and 2023, resulting in capture of 292 and 173 Gila Topminnow, respectively (Reap et al. 2024).

M&A personnel completed sampling of Cottonwood Spring on April 9, 2024. The spring was accessed via a short hike from HWY 82. Cottonwood Spring is located on private land and permission from the landowner was required to access this site. One fixed station, CWS01-F, was surveyed beginning at the springhead and ending below the diversion ditch (Figure 63). Sampling was completed by 25 dip net sweeps.

A total of 200 Gila Topminnow was captured within one fixed station (Table 10). All fish were captured in the approximately 60-m long reach between the diversion box and the springhead. The remainder of the 100-m site below the diversion was dry. Overall CPUE increased this year by 3.05 individuals per m^2 compared to the 2023 survey (Figure 63). Catch and effort totals for CWS01-F are summarized in Table 10.

Two pools located in Sonoita Creek just below the diversion dam were assessed visually and no fishes were observed. Overall catch in recent years was consistent, around ~200 fish. Sampling was limited in some areas of the diversion dam due to algal growth along the bottom of the diversion pipe.

Water temperature, DO, pH, and conductivity at the springhead was 26.3 °C, 6.3 mg/L, 7.09, and 1,663 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 65-68).

Table 10. Summary of catch by dip net sweeps at Cottonwood Spring, Santa Cruz Co., Arizona, surveyed April 5, 2023. Total effort was 25 dip net sweeps or 8.84m^2.

Stations	Statistic	POOC <20	POOC >=20	Totals
CWS01-F (8.84 m^2)	Count	141	59	200
	% total catch	70.50%	29.50%	100.00%
	CPUE (ind/m^2)	15.95	6.67	22.62

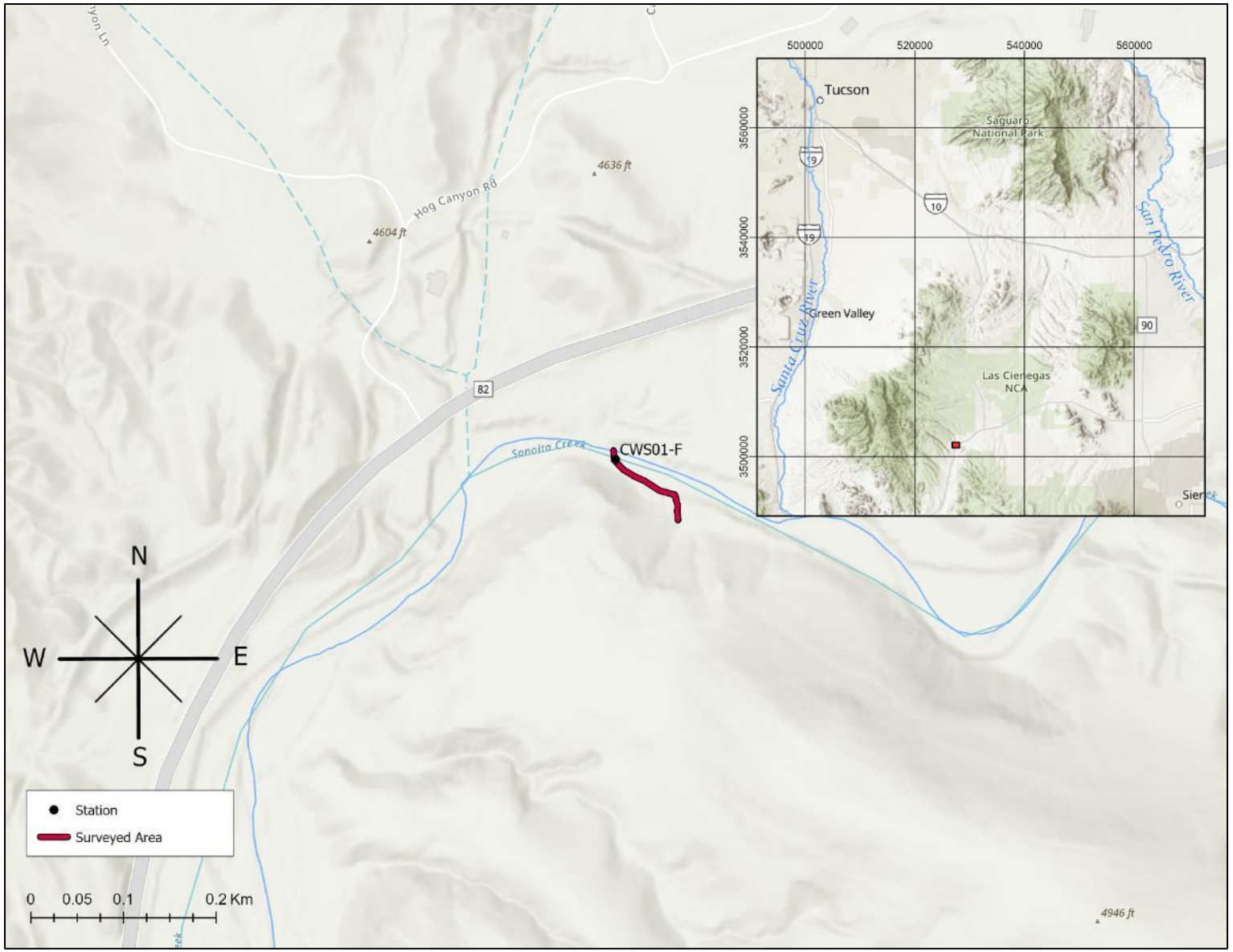

Figure 63. Location of sampled stations at Cottonwood Spring, Santa Cruz Co., Arizona, surveyed April 9, 2024.

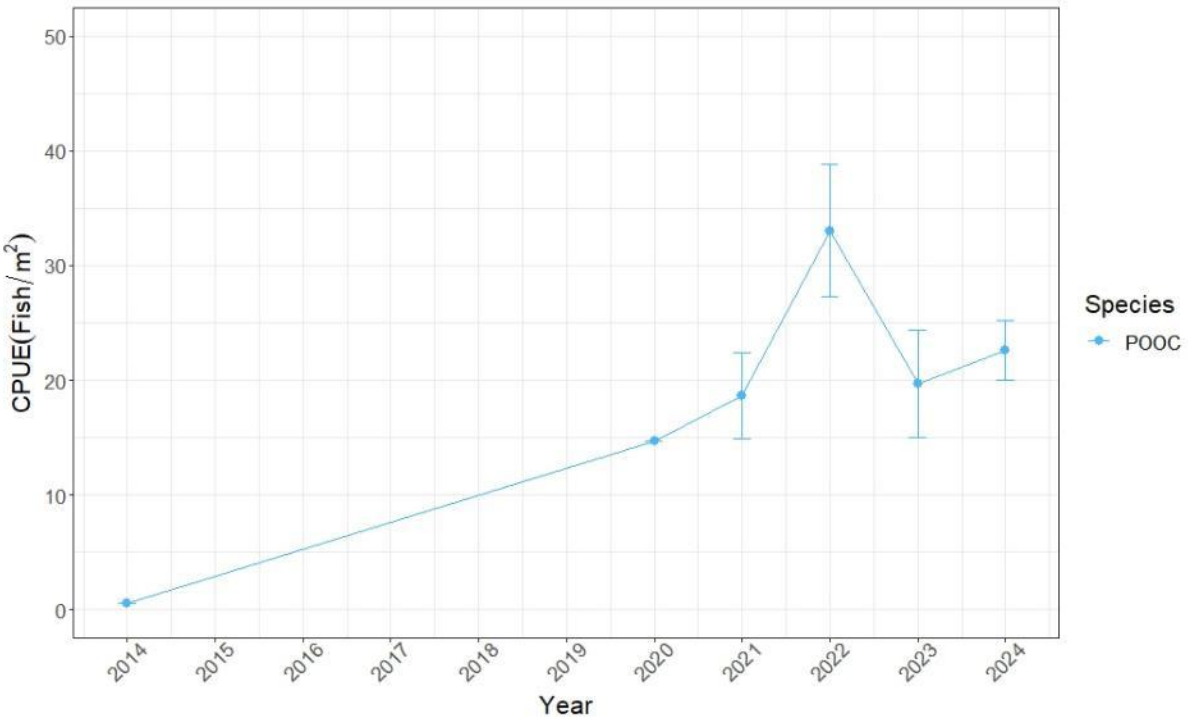

Figure 64. Mean CPUE of Gila Topminnow caught at Cottonwood Spring, Santa Cruz Co., Arizona, since 2014. Total catch for any particular survey year is denoted above the blue marker.

Figure 65. Upstream to upstream view of CWS01-F, Cottonwood Spring, Arizona.

Figure 66. Upstream to downstream view of CWS01-F, Cottonwood Spring, Arizona.

Figure 67. Downstream to downstream view of CWS01-F, Cottonwood Spring, Arizona.

Figure 68. Downstream to upstream view of CWS01-F, Cottonwood Spring, Arizona.

Monkey Spring April 9, 2024

Station		Lower Boundary	Upper Boundary
MKS01-F	12R NAD83	528085E, 3499695N	528070E, 3499792N

Monkey Spring (Santa Cruz Co., AZ) is tributary to Sonoita Creek near Patagonia, AZ (Figure 68). The focal species at Monkey Spring was Gila Topminnow. Monkey Spring has long been recognized as a unique habitat. The natural population of Gila Topminnow here has been the source of many wild replicate stockings around the state (Weedman 1999). It also was occupied historically by Santa Cruz (Monkey Spring) pupfish *Cyprinodon arcuatus* and a morphologically distinct form of Gila Chub, both of which are extirpated from this site; the pupfish is extinct. This site is surveyed annually for GRBNFMP, and 284 Gila Topminnow were captured in 2021, 225 in 2022, and 103 in 2023 (Shollenberger et al. 2023).

M&A personnel completed sampling of Monkey Spring on April 9, 2024. Sampling was completed by seine hauls. Monkey Spring was accessed via the Rail X Ranch just off SR-82. This site is on private property and landowner permission was required to access this sampling location.

One fixed sampling station, MKS01-F, was surveyed (Figure 69). This station encompassed the entirety of the pipe rail-enclosed spring and 56-m of the cement flume immediately downstream of the spring. Ten, 1-m seine hauls were completed, five within the flume and five in the enclosed spring. In addition, three dip net sweeps were conducted in areas too narrow to fit a seine. A total of 51 Gila Topminnow was captured. No other fish species were detected. Catch and effort totals for MKS01-F are summarized in Tables 11 and 12.

The majority of Gila Topminnow captured (n=50) were in the cement canal below the enclosed spring. There was no surface water present outside of the cement canal and enclosed spring. Numerous YOY Gila Topminnow were observed that were small enough to fit though the 1/8-inch mesh of the seine. Due to reduced effectiveness of seining within the springhead by vegetation and narrow water flow; personnel attempted to dip net in the same area but did not visually observe any fish to warrant an actual attempt. Dip netting was effective however, in the cement canal where the edges of cement have given way and water was less turbid. YOY Gila Topminnow were observed in this habitat and personnel were able to capture 26 fish in three dip net sweeps.

Water temperature, DO, pH, and conductivity at the fixed station were 27.2 °C, 7.4 mg/L, 7.14, and 1,309 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 71-74).

Mean CPUE of Gila Topminnow has steadily decreased since 2021 (Figure 70). Water quality and surface water have been consistent since 2021, indicating there is another variable causing the decrease in Gila Topminnow abundance at Monkey Spring. It is possible fish are moving downstream in the canal. A visual assessment downstream of the site extent in 2025 is necessary to confirm this hypothesis.

Table 11. Summary of catch by seine at Monkey Spring, Santa Cruz Co., Arizona, surveyed April 9, 2024. Total effort was 10 seine hauls or 36.58 m².

Stations	Statistic	POOC <20	POOC >=20	Totals
MKS01-F (36.58 m²)	Count	9	16	25
	% total catch	36.00%	64.00%	100.00%
	CPUE (ind/m²)	0.25	0.44	0.68

Table 12. Summary of catch by dip net at Monkey Spring, Santa Cruz Co., Arizona, surveyed April 9, 2024. Total effort was 3 dip net sweeps or 1.06 m².

Stations	Statistic	POOC <20	POOC >=20	Totals
MKS01-F (1.06 m²)	Count	26	0	26
	% total catch	100.00%	0.00%	100.00%
	CPUE (ind/m²)	24.53	0.00	24.53

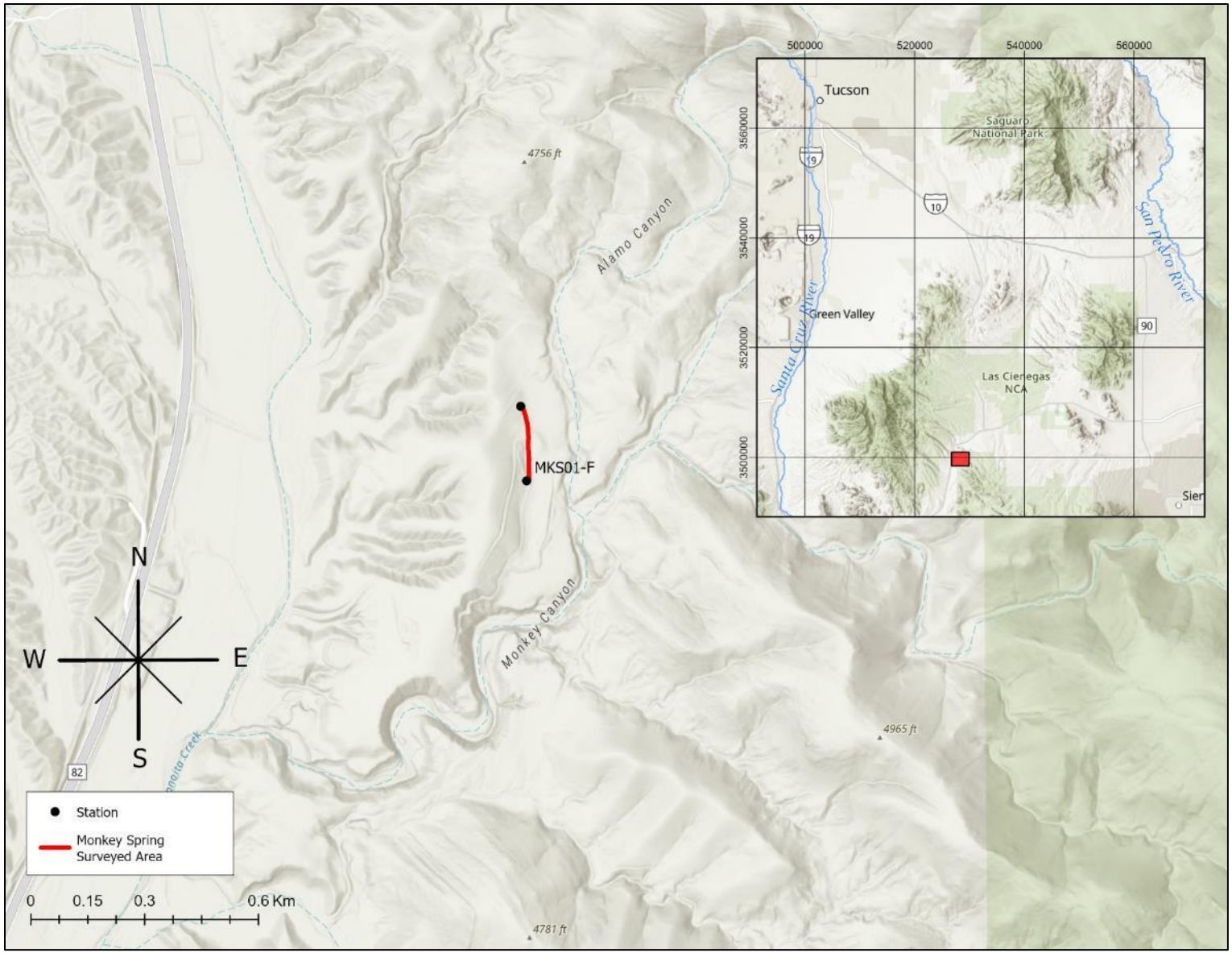

Figure 69. Location of sampled station at Monkey Spring, Santa Cruz Co., Arizona, surveyed April 9, 2024.

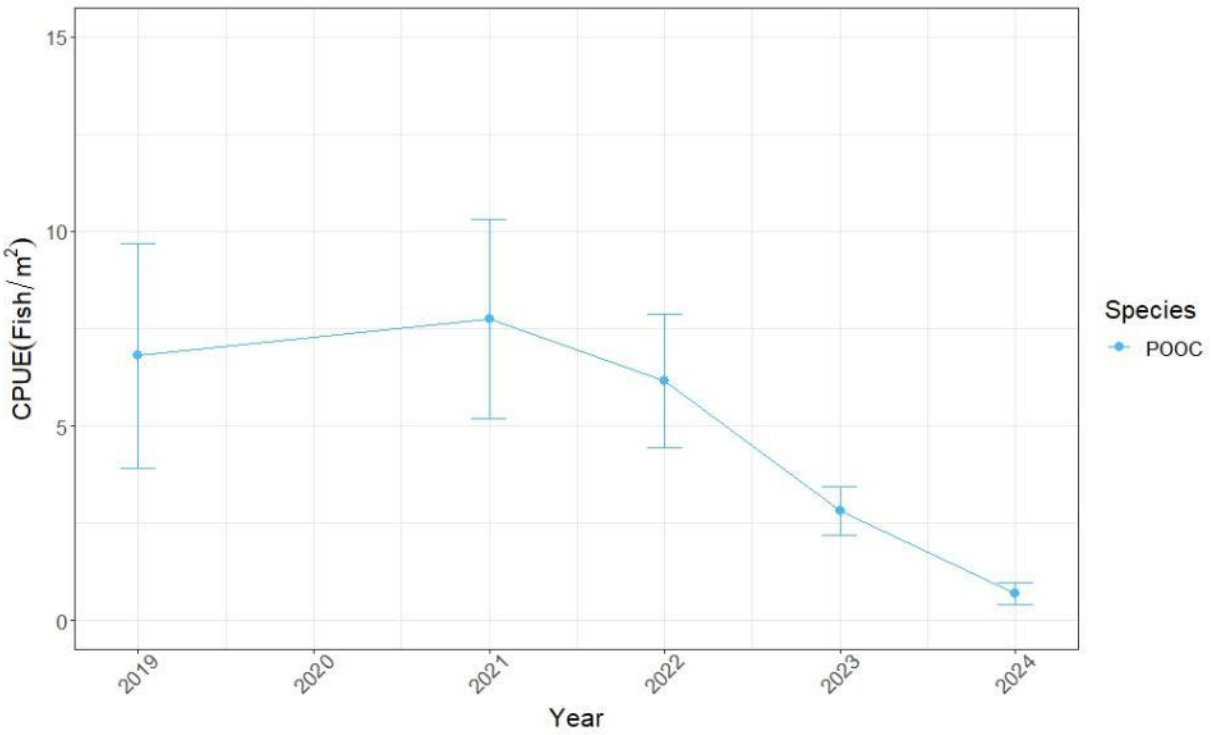

Figure 70. Mean CPUE of Gila Topminnow captured at Monkey Spring, Santa Cruz Co., Arizona, since 2019.

Figure 71. Upstream to upstream view of MKS01-F, Monkey Spring, Arizona.

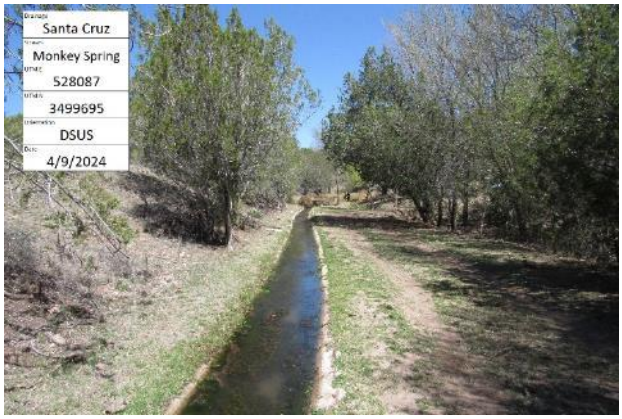

Figure 72. Downstream to upstream view of MKS01-F, Monkey Spring, Arizona.

Figure 73. Downstream to downstream view of MKS01-F, Monkey Spring, Arizona.

Figure 74. Upstream to downstream view of MKS01-F, Monkey Spring, Arizona.

Fresno Canyon April 10, 2024

Station		Lower Boundary	Upper Boundary
FRC01-F	12R NAD83	507749E, 3485964N	507848E, 3485986N
FRC02-F		507729E, 3485860N	507749E, 3485959N
FRC03-F		507745E, 3485724N	507727E, 3485857N

Fresno Canyon (Santa Cruz Co., AZ) is tributary to Sonoita Creek downstream of Patagonia Lake in Santa Cruz sub-basin. The natural population of Gila Topminnow was discovered in Fresno Canyon in 1992 (Weedman, 1999). Due to the presence of predatory non-natives such as Green Sunfish, Fresno Canyon was treated with rotenone in 2007. Prior to renovation, approximately 1,200 Gila Topminnow were salvaged from Fresno Canyon and transported 3 miles to Coal Mine Spring (Mitchell 2007). In 2008, 1,000 Gila Topminnow and 75 Longfin Dace from Coal Mine Canyon were translocated into Fresno Canyon (AZGFD 2018). Gila Topminnow was the focal species at Fresno Canyon. This site is surveyed annually for GRBNFMP; 24, 1,242, and 1,016 Gila Topminnow were captured in 2021, 2022, and 2023, respectively (Reap et al. 2024).

M&A personnel surveyed Fresno Canyon on April 10, 2024. Fresno Canyon was accessed by hiking 3.3 km from the end of Montezuma Well Road (reference the Coal Mine Canyon trip summary above for specific driving directions and coordination for this site). Three consecutive, 100-m fixed stations were surveyed (Figure 75). Ten minnow traps were set within each station for approximately 2 hours. Surface water was similar to conditions experienced in 2023. Still, there was little flowing water and mesohabitat consisted of mostly disconnected pools. Totals of 466 Gila Topminnow and 213 Longfin Dace were captured across all stations (Table 13).

Efforts in the upper station captured Gila Topminnow (n=210) and Longfin Dace (n=117). The fence near the upper portion of this perennial stretch is still damaged and cattle impacts were readily apparent, and several cows were observed on the hike to the monitoring reach. Efforts in the middle station captured Gila Topminnow (n=95), Longfin Dace (n=6), Lowland Leopard Frog tadpoles (n=6), and Green Sunfish (n=3). Efforts within the downstream station captured Gila Topminnow (n=161) and Longfin Dace (n=213).

Stream discharge measurements were not taken as there was no flowing water. Average water temperature, DO, pH, and conductivity across the three fixed stations was 15.3 °C, 7.63 mg/L, 7.77, and 428 µS, respectively. Photographs of upper and lower extents of each fixed station are provided below (Figures 77-84).

Mean CPUE of Gila Topminnow decreased from the previous two survey years (6.81; 2024, 14.47 (2023); Figure 76). A Green Sunfish (75 mm TL) was captured at this site in 2022. No Green Sunfish were captured or observed in 2023, however three YOY Green Sunfish measuring 17-, 20-, and 22-mm TL were captured in minnow traps within one pool in the middle station in 2024. The pool appears isolated by a series of step-runs above and a shallow run below. AZGFD personnel conducted a survey May 21, 2024, and captured 35 Green Sunfish. All but one Green Sunfish were YOY and likely spawned earlier in the spring. Green Sunfish were captured at the pool described in the middle station above and at the most downstream pool that has been documented to dry in recent survey years under GRBNFMP. It is

necessary to deploy mini hoop-nets in 2025's survey to better understand the distribution and relative abundance of Green Sunfish within Fresno Canyon, as well as assess the effectiveness of removal efforts conducted by AZGFD.

Table 13. Summary of catch by minnow trap at Fresno Canyon, Santa Cruz Co., Arizona, surveyed April 10, 2024. Total effort was 68.4 trap hours.

Stations	Statistic	POOC <20	POOC >=20	AGCH <40	AGCH >=40	LECY	RANA	Totals
FRC01-F (24.5 hrs)	Count	85	125	3	114	0	0	327
	% total catch	25.99%	38.23%	0.92%	34.86%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	3.47	5.10	0.12	4.65	0.00	0.00	13.33
FRC02-F (22.1 hrs)	Count	60	35	0	6	3	6	110
	% total catch	54.55%	31.82%	0.00%	5.45%	2.73%	5.45%	100.00%
	CPUE (ind/hr)	2.72	1.59	0.00	0.27	0.14	0.27	4.99
FRC03-F (21.8 hrs)	Count	42	119	17	73	0	0	251
	% total catch	16.73%	17.00%	82.14%	0.00%	7.14%	7.14%	100.00%
	CPUE (ind/hr)	1.92	5.45	0.78	3.34	0.00	0.00	11.49
	Count	187	279	20	193	3	6	688
	% total catch	27.18%	40.55%	2.91%	28.05%	0.44%	0.87%	100.00%
	CPUE (ind/hr)	2.73	4.08	0.29	2.82	0.04	0.09	10.05

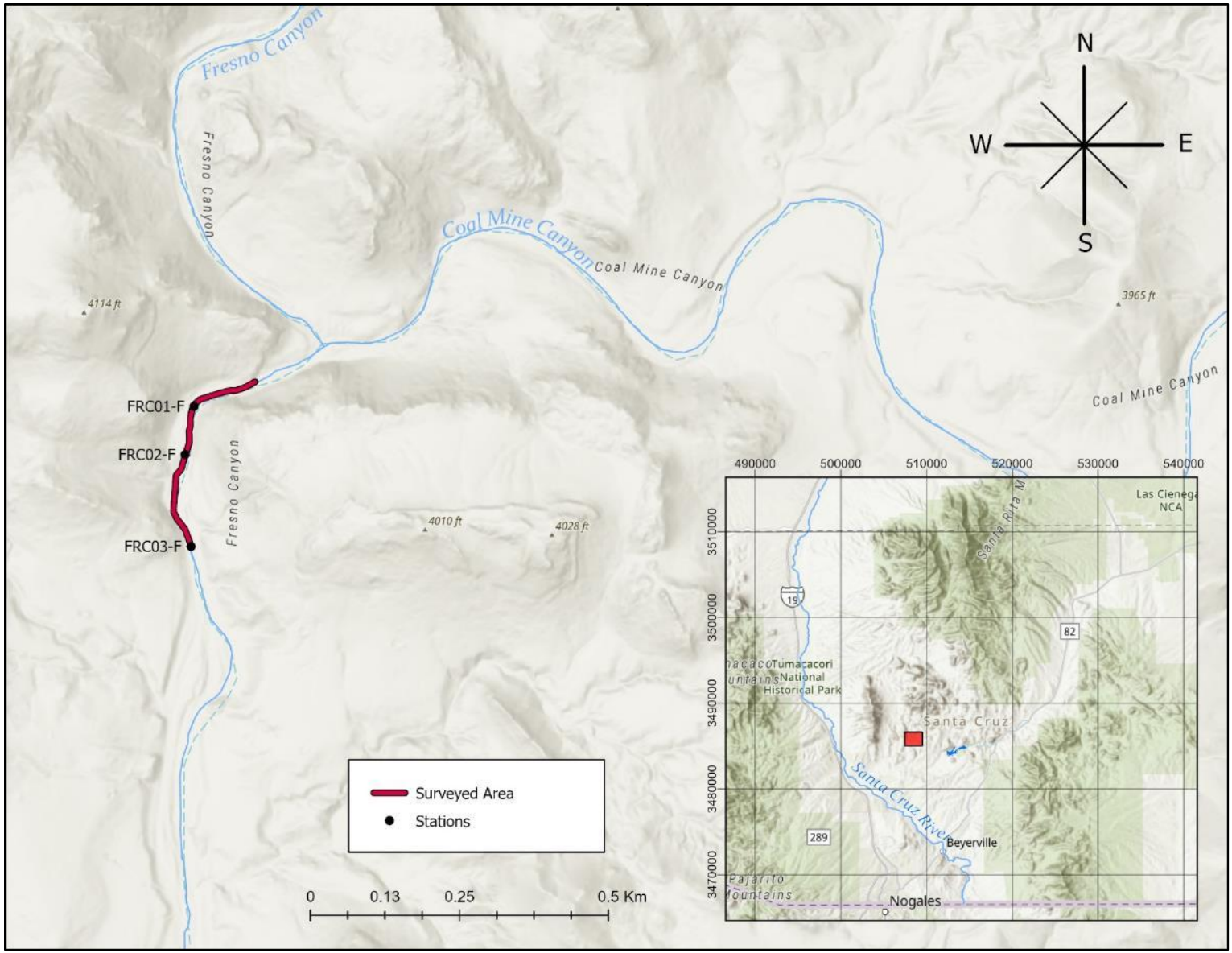

Figure 75. Location of sampled stations at Fresno Canyon, Santa Cruz Co., Arizona, surveyed April 10, 2024.

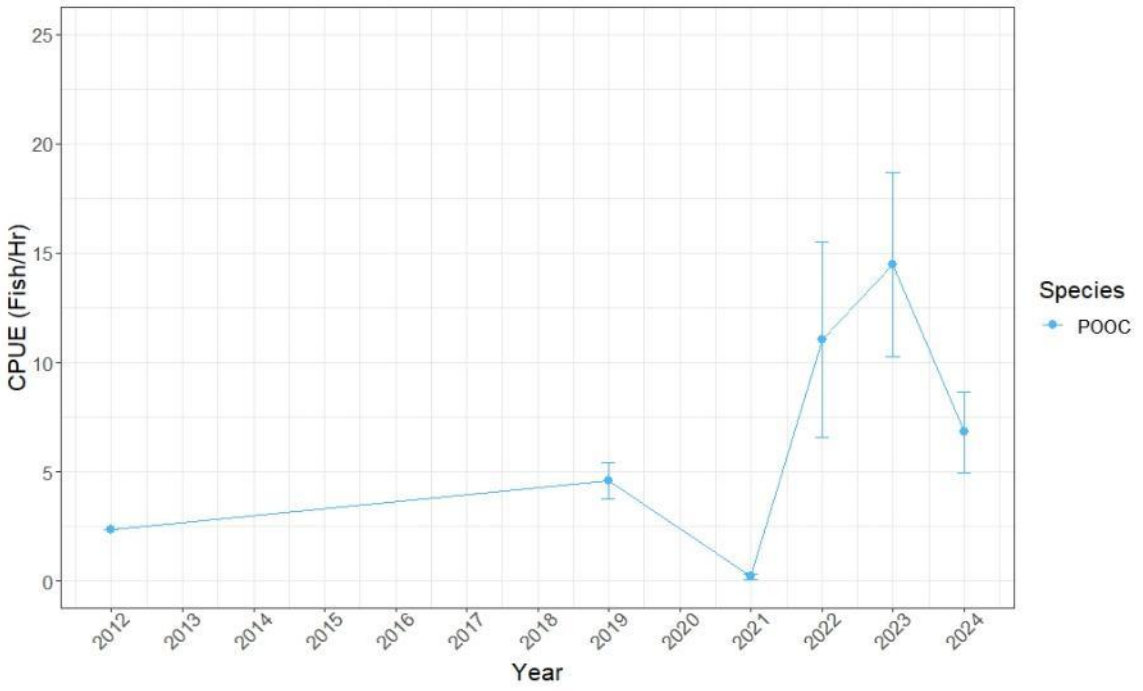

Figure 76. CPUE trend of Gila Topminnow captured at Fresno Canyon, Santa Cruz Co., Arizona, 2012-2024.

Figure 77. Upstream to downstream view of FRC01-F, Fresno Canyon, Arizona.

Figure 78. Upstream to upstream view of FRC01-F, Fresno Canyon, Arizona.

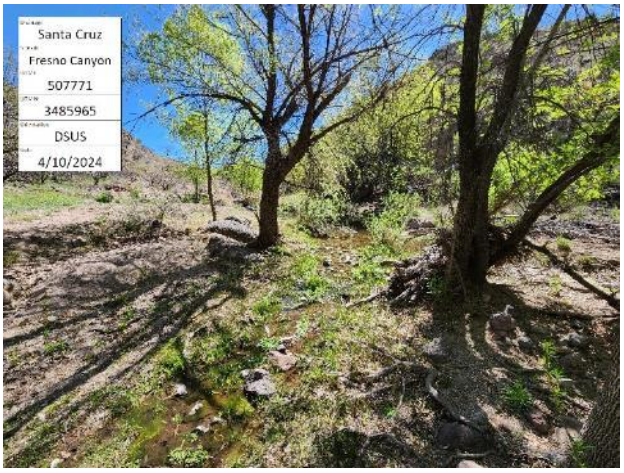

Figure 79. Downstream to upstream view of FRC01-F, upstream to upstream view of FRC02-F, Fresno Canyon, Arizona.

Figure 80. Downstream to downstream view of FRC01-F, upstream to downstream view of FRC02-F, Fresno Canyon, Arizona.

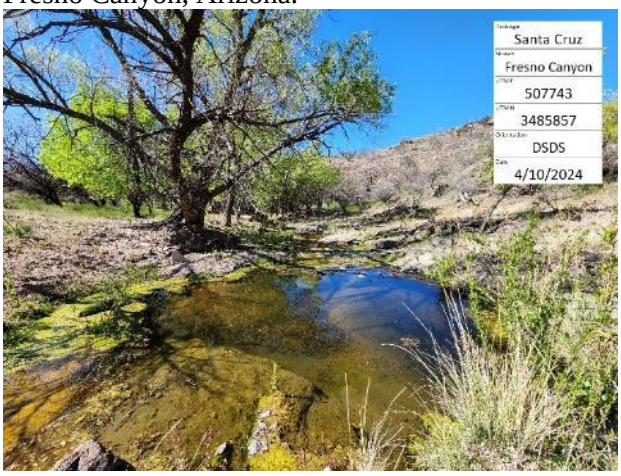

Figure 81. Downstream to downstream view of FRC02-F, upstream to downstream view of FRC03-F, Fresno Canyon, Arizona.

Figure 82. Downstream to upstream view of FRC02-F, upstream to upstream view of FRC03-F, Fresno Canyon, Arizona.

Figure 83. Downstream to upstream view of FRC03-F, Fresno Canyon, Arizona.

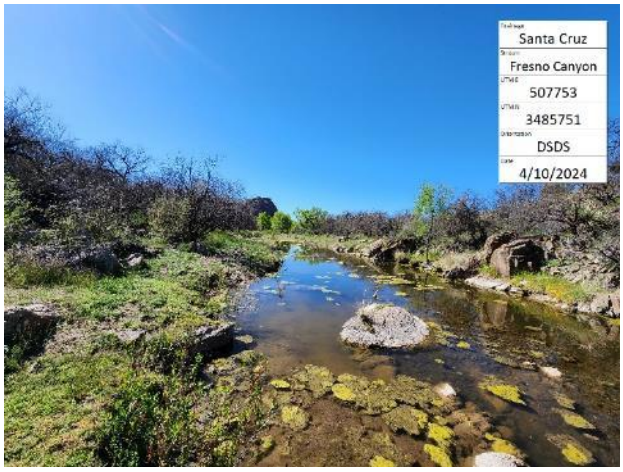

Figure 84. Downstream to downstream view of FRC03-F, Fresno Canyon, Arizona.

Sheehy Spring April 22, 2024

Station		Lower Boundary	Upper Boundary
SHS01-F	12R NAD83	540094E, 3470462N	540179E, 3470483N
SHS02-F		540004E, 3470442N	540094E, 3470462N

Sheehy Spring (Santa Cruz Co., AZ) is tributary to Santa Cruz River in San Rafael Valley near Lochiel, AZ. This site is on private land and permission to access the spring was acquired from San Rafael Cattle Company. Gila Chub was the focal species at Sheehy Spring. A natural population of Gila Chub was first discovered at this site in 1939. Gila Topminnow also existed at this site, however the population declined and eventually disappeared after the introduction of Western Mosquitofish in 1988 (Weedman et al. 1996). Sheehy Spring is surveyed annually for GRBNFMP. The 2023 monitoring event captured totals of 61 Gila Chub and 16 Western Mosquitofish (Reap et al. 2024).

M&A personnel and Doug Duncan (US Fish and Wildlife Service, retired) completed sampling of Sheehy Spring on April 22-23, 2024. Available habitat was mostly limited to one large pool in a 200-m perennial section surrounding the spring. The area surrounding Sheehy Spring was impacted by grazing cattle, however, dense woody vegetation protected the pool from direct impacts. Sampling was completed by mini-hoop nets baited with dry dog food.

Two, 100-m fixed stations were sampled at Sheehy Spring (Figure 85). These stations were immediately adjacent to each other and encompassed the majority of surface water present. Ten mini-hoop nets were set throughout a 45-m long series of connected pools located in the lower station, SHS02-F. Algal mats, which covered much of the open water, were cleared from the surface before setting mini-hoop nets. Ten nets were set overnight for approximately 20 hours. Remaining surface water was limited to marshland and shallow, muddy puddles. Totals of 46 Gila Chub, and 13 American Bullfrogs (2 adults; 11 tadpoles) were captured from the downstream station (Table 14). Sonoran Mud Turtles and Western Mosquitofish were not captured or observed in this survey despite being captured in the past three surveys.

The most upstream station (SHS01-F) began immediately upstream of a large pool. Mesohabitat throughout this station was limited to shallow puddles and marshy areas with some trickling water through grassland. Catch totals for all fish captured are summarized in Table 14 provided below.

Surface water was lower this year compared to 2023, however Gila Chub habitat still was limited to the large pool within the lower station. This population remains small, but stable. Mean CPUE remained low for Gila Chub but has been increasing with each monitoring event before 2024 (Figure 86). A length-frequency histogram for all Gila Chub captured in 2021, 2022, 2023, and 2024 at Sheehy Spring is included below (Figure 87). Water temperature, DO, pH, and conductivity taken at SHS02-F were 13.4 °C, 9.6 mg/L, 7.95, and 401 µS, respectively. Photographs of upper and lower extents are provided below (Figures 88-93).

Table 14. Summary of catch by mini hoop net at Sheehy Springs, Santa Cruz Co., Arizona, surveyed April 22-23, 2024. Total effort was 229.1 trap hours.

Station	Statistic	GIIN (51-100)	GIIN (>100)	RACA	Total
SHS02-F (229.1 hrs)	Count	5	41	13	59
	% total catch	8.47%	69.49%	22.03%	100.00%
	CPUE (ind/net hr)	0.02	0.18	0.06	0.26

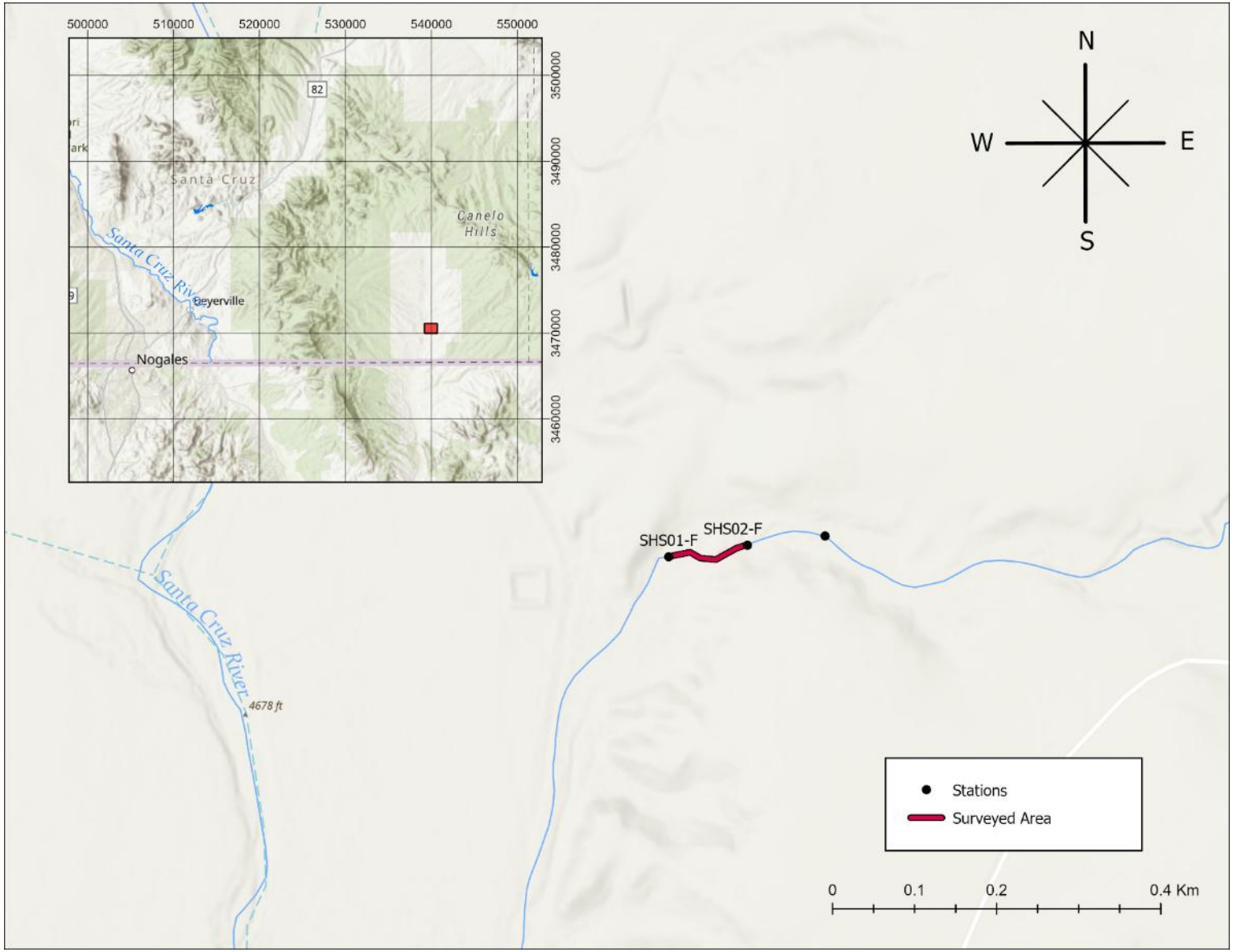

Figure 85. Location of sampled stations at Sheehy Springs, Santa Cruz Co., Arizona, surveyed April 22-23, 2024.

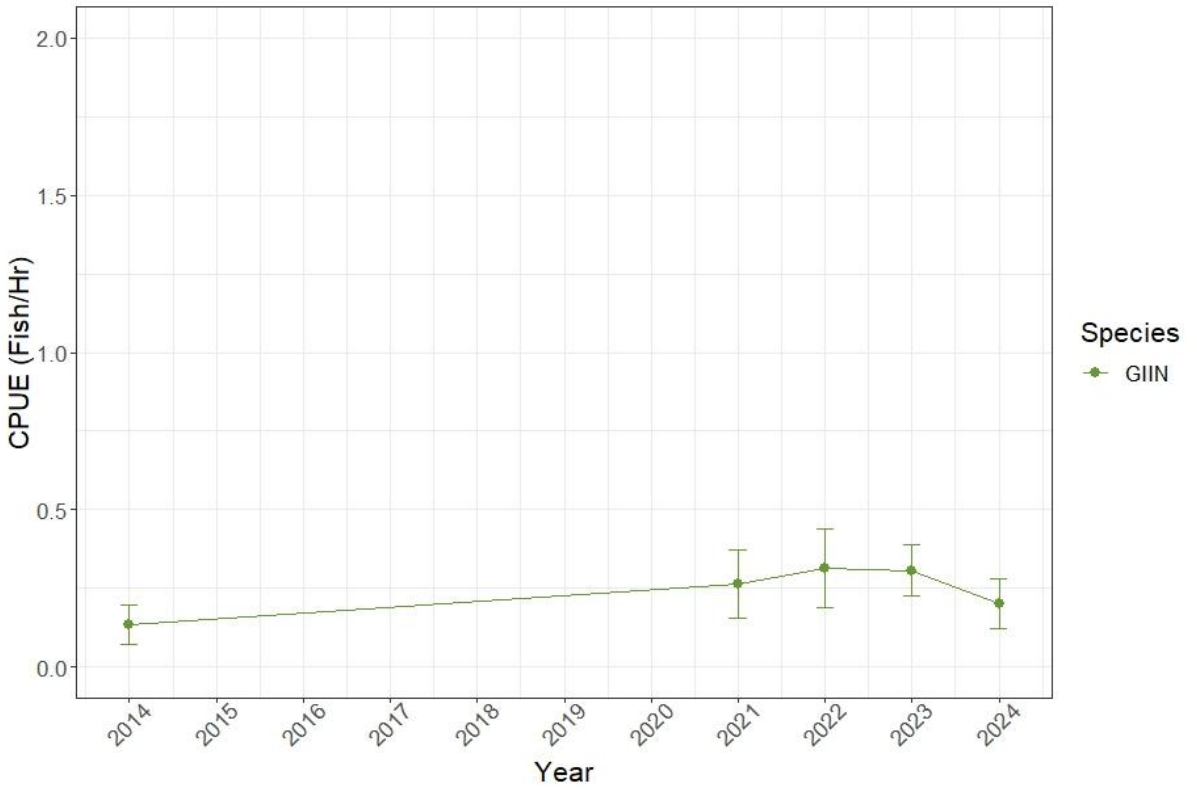

Figure 86. Mean CPUE of Gila Chub captured at Sheehy Springs, Santa Cruz Co., Arizona, since 2014.

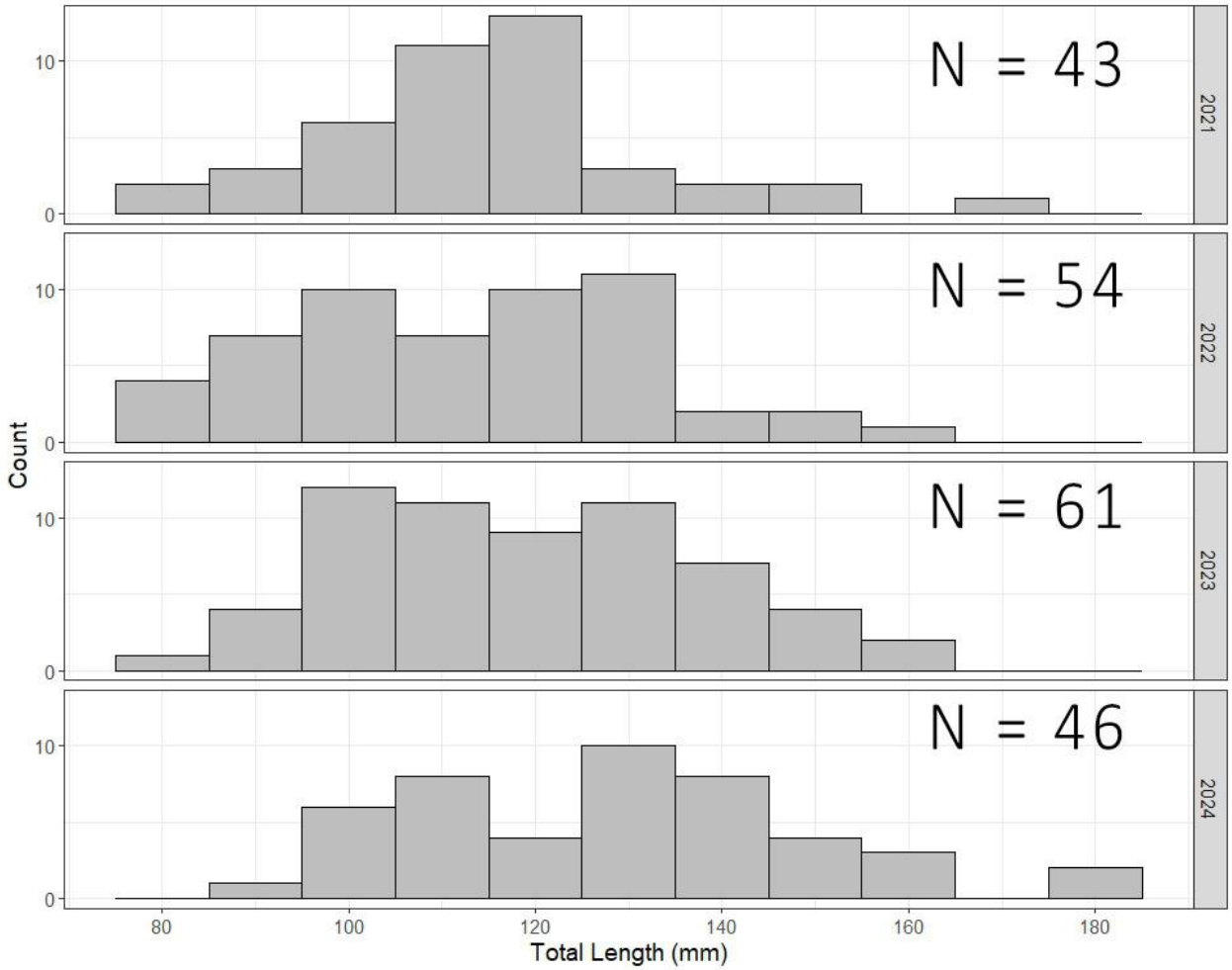

Figure 87. Length-frequency histogram of Gila Chub captured under GRBNFMP 2021-2024, Sheehy Springs, Santa Cruz Co., Arizona.

Figure 88. Downstream to downstream view of SHS02-F, Sheehy Spring, Arizona.

Figure 89. Downstream to upstream view of SHS02-F, Sheehy Spring, Arizona.

Figure 90. Upstream to upstream view of SHS02-F, Downstream to upstream view of SHS01-F, Sheehy Spring, Arizona.

Figure 91. Upstream to downstream view of SHS02-F, downstream to downstream view of SHS01-F, Sheehy Spring, Arizona.

Figure 92. Upstream to upstream view of SHS01-F, Sheehy Spring, Arizona.

Figure 93. Upstream to downstream view of SHS01-F, Sheehy Spring, Arizona.

Cienega Creek September 5, 2024

Station		Lower Boundary	Upper Boundary
CNC02	12S NAD83	535688E, 3541877N	535760E, 3541929N
CNC03-F		535600E, 3541855N	353685E, 3541876N
CNC06		535318E, 3541934N	535475E, 3541880N

Cienega Creek (Pima Co., AZ) is located in Pima County Cienega Creek Natural Preserve near Vail, AZ. It is tributary to Pantano Wash in Santa Cruz sub-basin. Gila Topminnow was the focal species for this site. Cienega Creek is monitored annually under this monitoring program. During the 2021 and 2022 surveys, 26 and six Gila Topminnow were captured, respectively (Reap et al. 2024). None were captured in 2023, however one seine haul conducted at the three bridges area confirmed the presence of Gila Topminnow.

M&A and Pima County personnel completed monitoring of Cienega Creek on September 5, 2024. One fixed and two random stations were surveyed in the vicinity of the "Horseshoe Bend/Head Cut" section of the creek (Figure 94). This reach of Cienega Creek was accessed via gravel roads off East Marsh Station Road. Ten seine hauls were conducted at random station CNC06, only six seine hauls were conducted at CNC02 due to overgrown cattails making seining ineffective in ~40% of the available habitat. Ten minnow traps baited with dry dog food were used throughout the fixed station set for approximately two hours. Across all stations, 3,842 Longfin Dace were captured.

Mesohabitat in fixed station CNC03-F was different than what was encountered in 2022 and 2023. Historically, the fixed station had a single deep pool along a rocky cliff that had been filled in with sediment prior to survey efforts in 2022. The sediment filled pool measured at 6.1-m in length, 5.4-m wide, and 0.6-m maximum depth in 2023. The same pool in 2024 measured 20.1-m long, 6.1-m wide, and 1.2-m maximum depth. Ten minnow traps were set for approximately two hours. Only Longfin Dace (n=2,914) were captured at this station.

The first random station, CNC02, was located immediately upstream of the fixed station. Only Longfin Dace (n=205) were captured via seine hauls. The second random station, CNC06, was 300-m downstream from the fixed station. Longfin Dace (n=673) were captured via seine hauls. Mesohabitat in both random stations mainly consisted of shallow, sandy riffles encroached by cattails separated by long deep silty runs. Catch and effort totals for all stations are summarized in Tables 15 and 16. No Gila Topminnow were observed in the survey extent.

Lowland Leopard Frog specimens collected by Pima County personnel tested positive for both *Batrachochytrium dendrobatidis* and ranavirus (A. Owens, AZGFD, pers. comm.) at this site in 2022. Many Lowland Leopard Frogs were observed across the monitoring reach, one was captured during this survey with no apparent health issues.

Stream discharge was taken at the fixed station and measured at 0.008m^3/s (0.304cfs). Water temperature, DO, pH, and conductivity at the fixed station were 20.5 °C, 7.4 mg/L, 8.00, and 1,232 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 95-98).

A single opportunistic dip net sweep captured two Gila Topminnow in the three bridges area downstream of the survey site. A similar effort confirmed the presence of Gila Topminnow in the same pool via seine haul in 2023. CPUE trends were difficult to assess for Cienega Creek as the majority of Gila Topminnow captured in 2021 and 2022 were from opportunistic efforts using a variety of gear types and none were captured in 2023 and 2024. It appears Gila Topminnow were swept out of the monitoring extent after flood events altered the perennial pools this population relied on to survive. Their presence was limited to the three bridges area during this time. The habitat encountered within the monitoring reach of Cienega Creek in 2024 suggests reintroduction of Gila Topminnow at this site would lead to establishment. More pools were encountered outside of the fixed station that are conducive to optimal Gila Topminnow habitat and are located at 535778E/3541942N and 535426E/3541906N.

Table 15. Summary of catch by minnow trap at Cienega Creek, Pima Co., Arizona, surveyed September 5, 2024. Total effort was 22.26 trap hours.

Station	Statistic	AGCH (<40)	AGCH (>=40)	Total
CNC03-F (22.3 hrs)	Count	1143	1771	2914
	% total catch	39.22%	60.78%	100.00%
	CPUE (ind/net hr)	51.35	79.56	130.91

Table 16. Summary of catch by seine haul at Cienega Creek, Pima Co., Arizona, surveyed September 5, 2024. Total effort was 58.5 m^2 or 16 seine hauls.

Station	Statistic	AGCH (<40)	AGCH (>=40)	Total
CNC02 (21.95 m²)	Count	204	51	255
	% total catch	80.00%	20.00%	100.00%
	CPUE (ind/m²)	9.29	2.32	11.62
Station	**Statistic**	**AGCH (<40)**	**AGCH (>=40)**	**Total**
CNC06 (36.58 m²)	Count	287	386	673
	% total catch	42.64%	57.36%	100.00%
	CPUE (ind/m²)	7.85	10.55	18.40

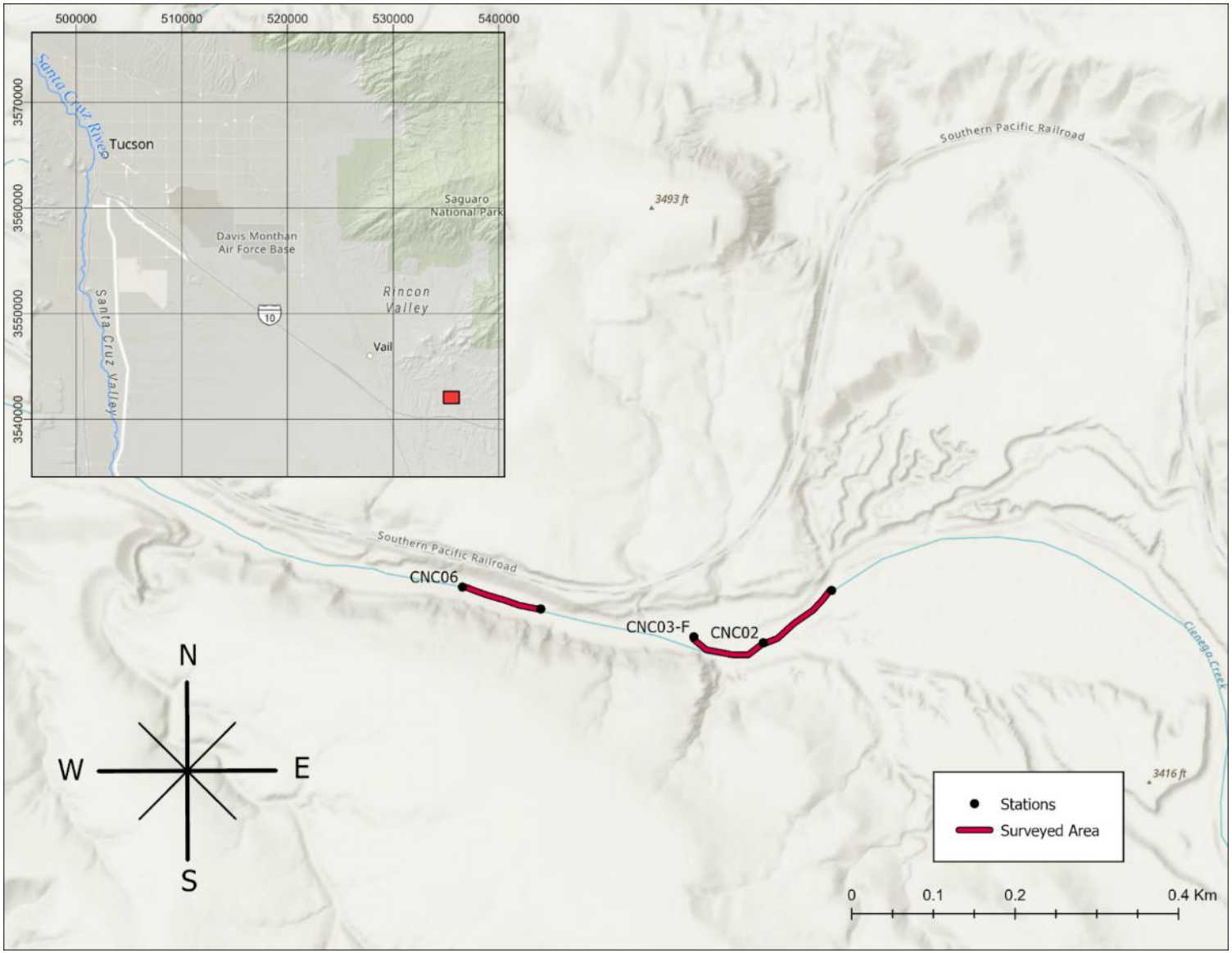

Figure 94. Location of sampled stations at Cienega Creek, Pima Co., Arizona, surveyed September 5, 2024.

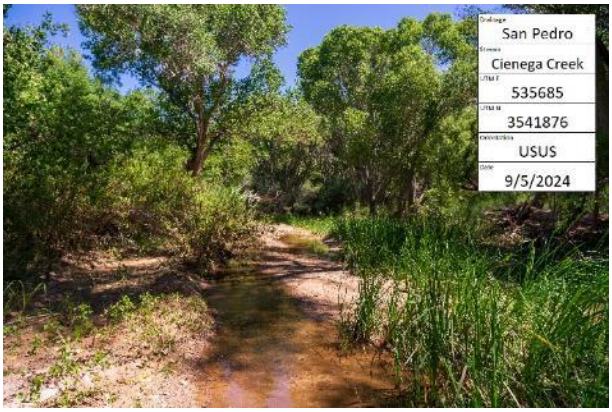

Figure 95. Upstream to upstream view of CNC03-F, Cienega Creek, Arizona.

Figure 96. Upstream to downstream view of CNC03-F, Cienega Creek, Arizona.

Figure 97. Downstream to upstream view of CNC03-F, Cienega Creek, Arizona.

Figure 98. Downstream to downstream view of CNC03-F, Cienega Creek, Arizona.

Station		Lower Boundary	Upper Boundary
RMC06-F	12S NAD83	511531E, 3586865N	511565E, 3586785N
RMC07		511464E, 3586946N	511528E, 3586864N
RMC11		511339E, 3587279N	511367E, 3587182N
RMC18		511147E, 3587421N	511124E, 3587317N
RMC24		510976E, 3587974N	511007E, 3587853N

Romero Canyon (Pima Co., AZ) is within the Santa Catalina Mountains north of Tucson, AZ in the Santa Cruz sub-basin. Romero Canyon has approximately 2.4 km of perennial water that begins 3.7 km upstream from its confluence with Sutherland Wash. Gila Chub was the focal species for this survey. Gila Chub was first stocked into Romero Canyon in 2005 with fish salvaged from Sabino Canyon (FWS, 2015). This population was augmented with 148 individuals in 2019 to expand their range further upstream (Hickerson et al. 2020). Romero Canyon was last surveyed for GRBNFMP in 2019, and 2021, prior to augmentation, and resulted in capture of 50 and 41 Gila Chub, respectively (Shollenberger et al. 2022).

M&A personnel completed sampling Romero Canyon on November 11, 2024. The survey reach was accessed via Romero Canyon Trailhead within Catalina State Park. Five stations (1 fixed, 4 random) were surveyed at Romero Canyon with the lowest station located 2.4 km downstream of Romero Canyon trail crossing and the most upstream site located 400-m downstream of the trail crossing (Figure 99). There was little trappable habitat outside of the fixed station (RMC06-F) and the random station immediately downstream (RMC07). A total of 122 Gila Chub was captured across all surveyed stations.

Two stations were wetted between the five stations sampled. Ten traps were set throughout the fixed station, RMC06-F. This station consisted of deep slick rock pools. Five mini-hoop nets were deployed, and these captured five Gila Chub. Five minnow traps were deployed to target young-of-year chub and captured 68 fish. The random station immediately downstream captured 49 Gila Chub using the same sampling methods. Most of the chub (n=44) captured were 51-100 mm and were caught using minnow traps.

The three remaining stations were dry throughout and could not be sampled with any gear type. Personnel came across deep, slick rock pools around station RMC14, but these appeared to be fishless. Canyon Treefrogs *Hyla arenicolor* were abundant throughout the survey reach. Catch and effort totals for all surveyed stations are summarized in Table 17.

Water temperature, dissolved oxygen, pH, and conductivity at the fixed station were recorded at 11.3 °C, 8.9 mg/L, 8.25, and 182 µS, respectively. A length-frequency histogram for all Gila Chub captured at Romero Canyon is included below (Figure 100). Photographs of upper and lower extents of the fixed station are provided below (Figures 101-104).

There was evidence of impacts from the 2019 Bighorn Fire within the drainage, which may have had adverse effects on the Gila Chub population evident in past surveys. Gila Chub appear to have survived the disturbance and were captured in deep, shaded pools that persisted despite drought-like conditions

experienced in the region. The abundance of Gila Chub catch increased from 2019 and 2021 surveys, but their distribution was limited to the two most upstream sampled stations.

Table 17. Catch summary table of Gila Chub captured at Romero Canyon, Pima Co., Arizona, November 12, 2024, via mini-hoop net and minnow traps. Total effort was 47.4 trap hours.

Station	Statistic	GIIN (<=50)	GIIN (51-100)	GIIN (>100)]	Total
RMC06-F (22.1 hrs)	Count	17	52	4	73
	% total catch	23.29%	71.23%	5.48%	100.00%
	CPUE (ind/hr)	0.77	2.36	0.18	3.31
RMC07 (25.3 hrs)	Count	6	38	5	49
	% total catch	12.24%	77.55%	10.20%	100.00%
	CPUE (ind/hr)	0.24	1.50	0.20	1.94
Total	Count	23	90	9	122
	% total catch	18.85%	73.77%	7.38%	100.00%
	CPUE (ind/hr)	0.49	1.90	0.19	2.57

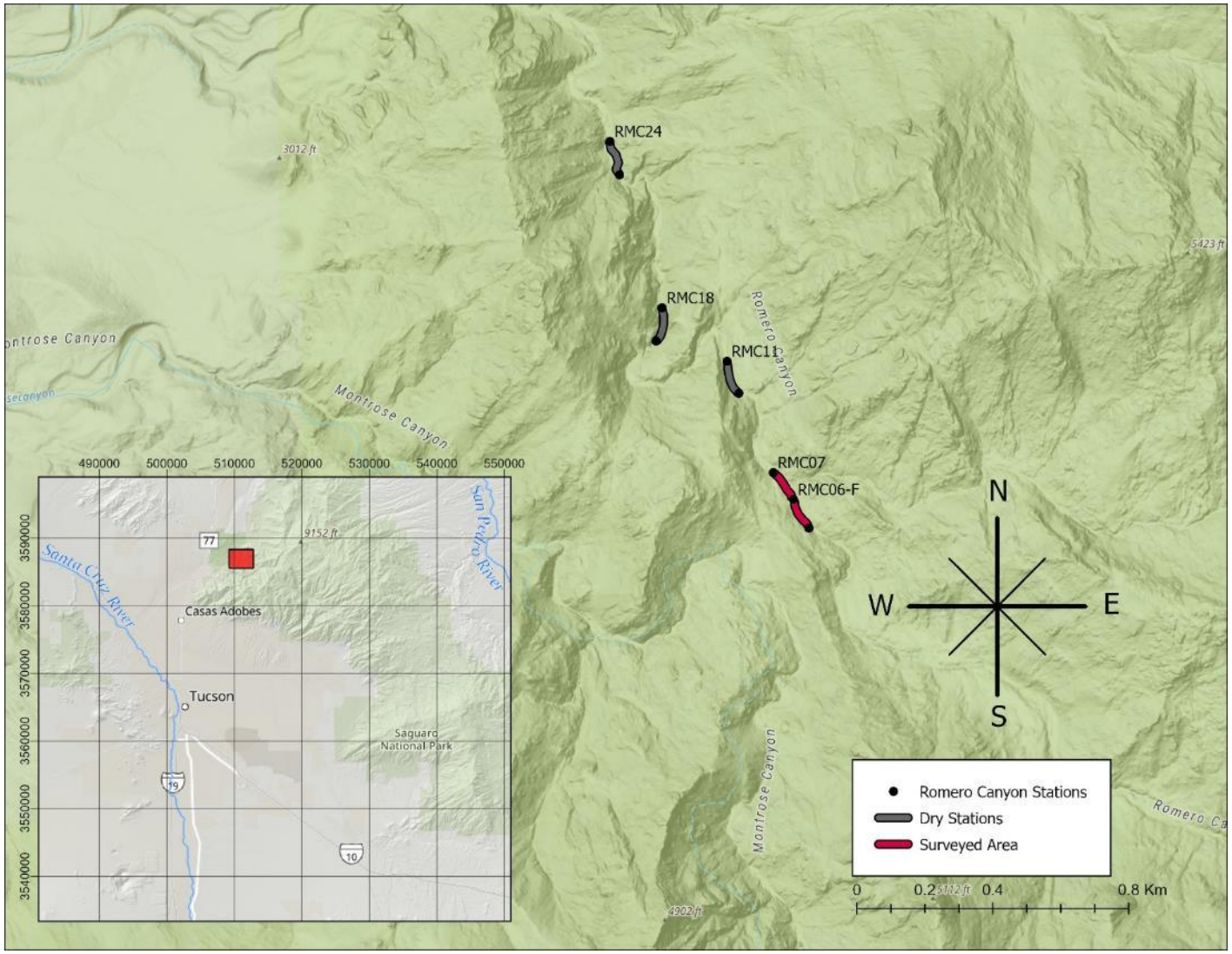

Figure 99. Location of sampled stations at Romero Canyon, Pima Co., Arizona, November 12, 2024.

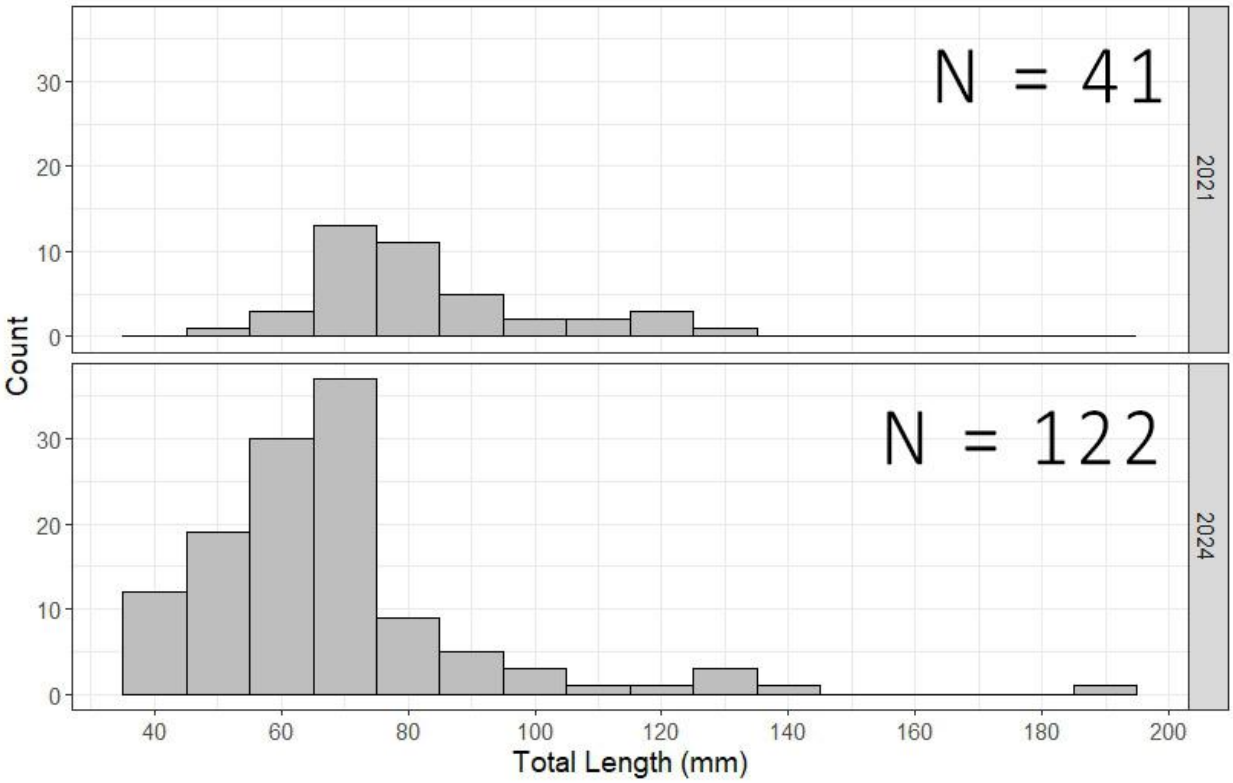

Figure 100. Length-frequency histogram of Gila Chub captured at Romero Canyon, Pima Co., Arizona, 2021 and 2024. Total chub captured is demonstrated in the top right.

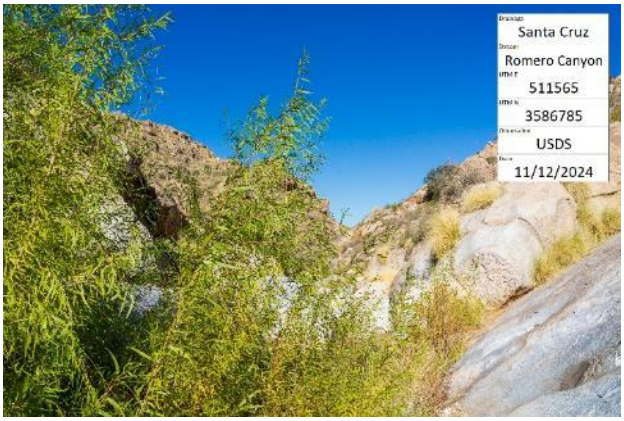

Figure 101. Upstream to downstream view of RMC06-F, Romero Canyon, Arizona.

Figure 102. Upstream to upstream view of RMC06-F, Romero Canyon, Arizona.

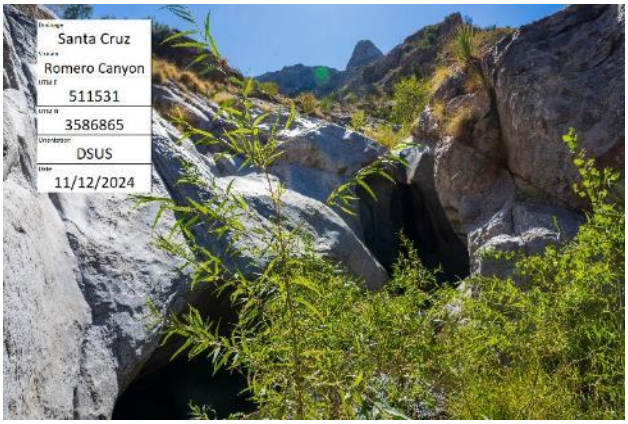

Figure 103. Downstream to upstream view of RMC06-F, Romero Canyon, Arizona.

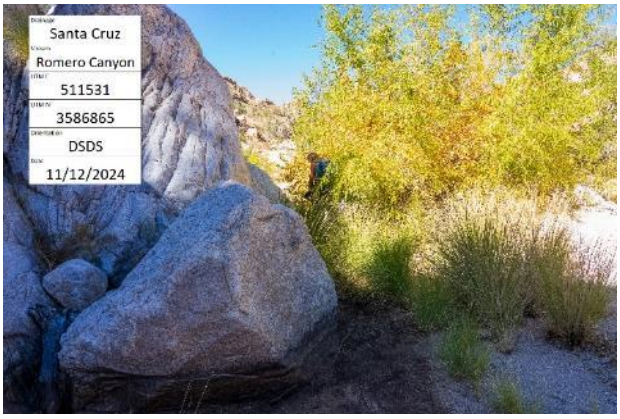

Figure 104. Downstream to downstream view of RMC06-F, Romero Canyon, Arizona.

Bear Canyon November 13, 2024

Station		Lower Boundary	Upper Boundary
BRC15	12S NAD83	522644E, 3578543N	522740E, 3578543N
BRC20		522354E, 3578227N	522422E, 3578289N
BRC33		521803E, 3577370N	521817E, 3577472N
BRC37-F		521521E, 3577150N	521640E, 3577154N

Bear Canyon (Pima Co., AZ) is located adjacent to Sabino Canyon in the Santa Catalina Mountains northeast of Tucson, AZ. Bear Canyon was stocked with Gila Chub in 2005, the status of the population was unknown until they were detected in 2018 and 2019. Gila Chub was the focal species for this site. Bear Canyon was surveyed for the GRBNFMP in 2021 and 42 Gila Chub were captured.

M&A personnel surveyed Bear Canyon on November 13, 2024. Four stations (1 fixed, 3 random) were surveyed in Bear Canyon between Seven Falls and Sycamore Canyon (Figure 105). Stations were accessed via Bear Canyon Trailhead in Sabino Canyon National Recreation Area. The most downstream station was located just above the top of Seven Falls and the most upstream station was 200-m upstream from the Bear Canyon trail creek crossing.

No fishes were detected at any of the surveyed stations. All stations were effectively dry with sparse shallow water observed flowing intermittently over slick bedrock. Three dip net sweeps in the fixed station (BRC37-F) captured zero fish. Gila Chub were confirmed below waterfalls at the Seven Falls area with rod and reel. In the two most downstream waterfalls, Gila Chub were observed in abundance (>100 individuals). A Ring-Necked Snake *Diadophis punctatus* was captured on the trail while hiking back from sampling.

Water temperature, dissolved oxygen, pH, and conductivity at the fixed station were 17.4 °C, 4.1 mg/L, 8.55, and 178 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 106-109).

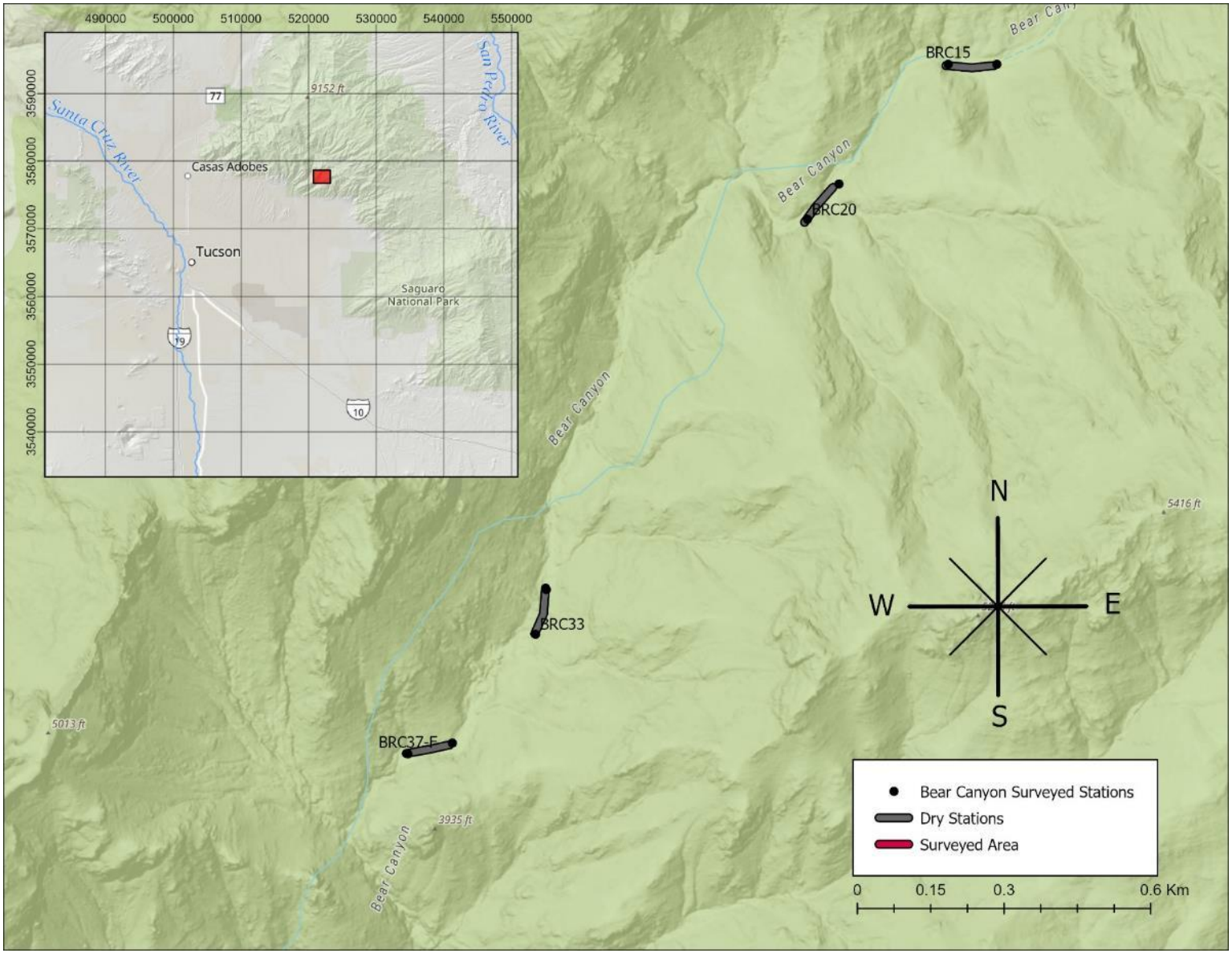

Figure 105. Location of surveyed stations at Bear Canyon, Pima Co., Arizona, November 13, 2024.

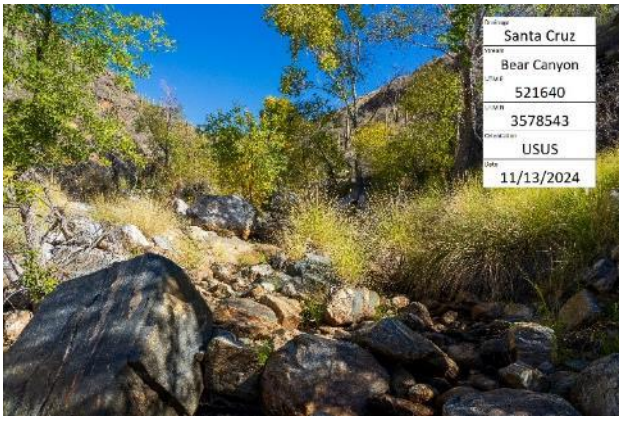

Figure 106. Upstream to upstream view of BRC37-F, Bear Canyon, Arizona.

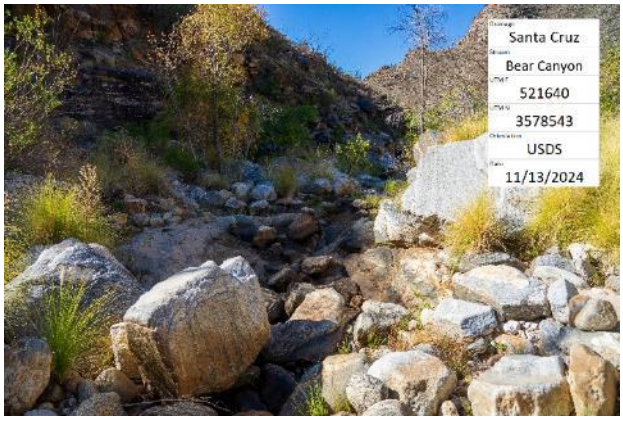

Figure 107. Upstream to downstream view of BRC37-F, Bear Canyon, Arizona.

Figure 108. Downstream to upstream view of BRC37-F, Bear Canyon, Arizona.

Figure 109. Downstream to downstream view of BRC37-F, Bear Canyon, Arizona.

Sabino Canyon November 14, 2024

Station		Lower Boundary	Upper Boundary
SBC03	12S NAD83	520473E, 3578442N	520453E, 3578510N
SBC06-F		520308E, 3578244N	520418E, 3578261N
SBC16		519787E, 3577445N	519852E, 3577530N
SBC20		519552E, 3577142N	519648E, 3577200N
SBC24		519226E, 3576976N	519322E, 3577013N
SBC27		518972E, 3576933N	519048E, 3576985N
SBC33		518401E, 3576567N	518520E, 3576609N
SBC40		517988E, 3576272N	518067E, 3576304N
SBC49		517860E, 3575556N	517797E, 3575619N
SBC53-F		517731E, 3575215N	517726E, 3575310N
SBC54		517771E, 3575122N	517732E, 3575215N

Sabino Canyon (Pima Co., AZ) is located within Coronado National Forest northeast of Tucson, AZ. Sabino Canyon flows for approximately 28 km before it empties into the Rillito River, although the lower portion of the canyon is primarily ephemeral. Sabino Canyon was chemically treated in 1999 to remove Green Sunfish. Salvaged Gila Chub were stocked into Sabino Canyon following treatment. Gila Topminnow (Cienega Creek lineage) was initially stocked in Sabino Canyon in 2015 (Hickerson et al. 2020). Gila Chub and Gila Topminnow were the focal species for this site. Sabino Canyon was last surveyed for Gila Chub as part of GRBMP in 2015 and 2021, resulting in capture of 252 and 143 Gila Chub, respectively (Timmons and Paulus 2016; Shollenberger et al. 2022). Also captured in 2021 were 217 Gila Topminnow.

M&A personnel completed monitoring of Sabino Canyon on November 14, 2024. The survey reach was accessed along Upper Sabino Canyon Road. This road typically is restricted to hikers and trams. Eleven stations (2 fixed, 9 random) were surveyed via minnow traps and mini-hoop nets. The lowest station was located 200-m below Sabino Creek Dam and the uppermost station was located 300-m upstream of Sabino Waterfall (Figure 110). Five minnow traps and five mini mini-hoop nets were set for approximately two hours at the two uppermost stations (SBC03 and SBC06-F), and supplemental dip net sweeps were performed at SBC24. Across all surveyed stations, 190 Gila Chub were captured (Tables 18 and 19). Gila Topminnow were not detected or observed in the surveyed stations. The remaining nine stations were entirely dry and could not be sampled. Canyon Tree Frogs were observed near pools in the uppermost stations.

Average water temperature, dissolved oxygen, pH, and conductivity at one fixed station was 9.8 °C, 23.2 mg/L, 7.80, and 153 µS, respectively. A length-frequency histogram for all Gila Chub captured at Sabino Canyon is included below (Figure 111). Photographs of upper and lower extents of each fixed station are provided below (Figures 112-119).

Gila Chub catch increased from the 143 captured in 2021, however, only three pools across two stations held fish. Almost the entire survey extent was dry up until SBC06-F. Gila Chub and Gila Topminnow could still be occupying areas above the survey reach. If drought conditions worsen, Gila Chub could be eradicated from the canyon.

Table 18. Summary of catch of Gila Chub captured via mini-hoop net and minnow trap at Sabino Canyon, Pima Co., Arizona, November 14, 2024. Total effort was 37.97 trap hours.

Station	Statistic	GIIN (<=50)	GIIN (51-100)	GIIN (>100)]	Total
SBC03 (20.1 hrs)	Count	23	90	0	113
	% total catch	20.35%	79.65%	0.00%	100.00%
	CPUE (ind/hr)	1.15	4.49	0.00	5.63
SBC06-F (17.9 hrs)	Count	26	40	3	69
	% total catch	37.68%	57.97%	4.35%	100.00%
	CPUE (ind/hr)	1.45	2.23	0.17	3.85
Total	Count	49	130	3	182
	% total catch	26.92%	71.43%	1.65%	100.00%
	CPUE (ind/hr)	1.29	3.42	0.08	4.79

Table 19. Summary of catch of Gila Chub captured via dip net at Sabino Canyon, Pima Co., Arizona, November 14, 2024. Total effort was three dip nets sweeps or 1.06 m^2.

Station	Statistic	GIIN (51-100)
SBC24 (1.06 m^2)	Count	8
	% total catch	100.00%
	CPUE (ind/m^2)	7.55

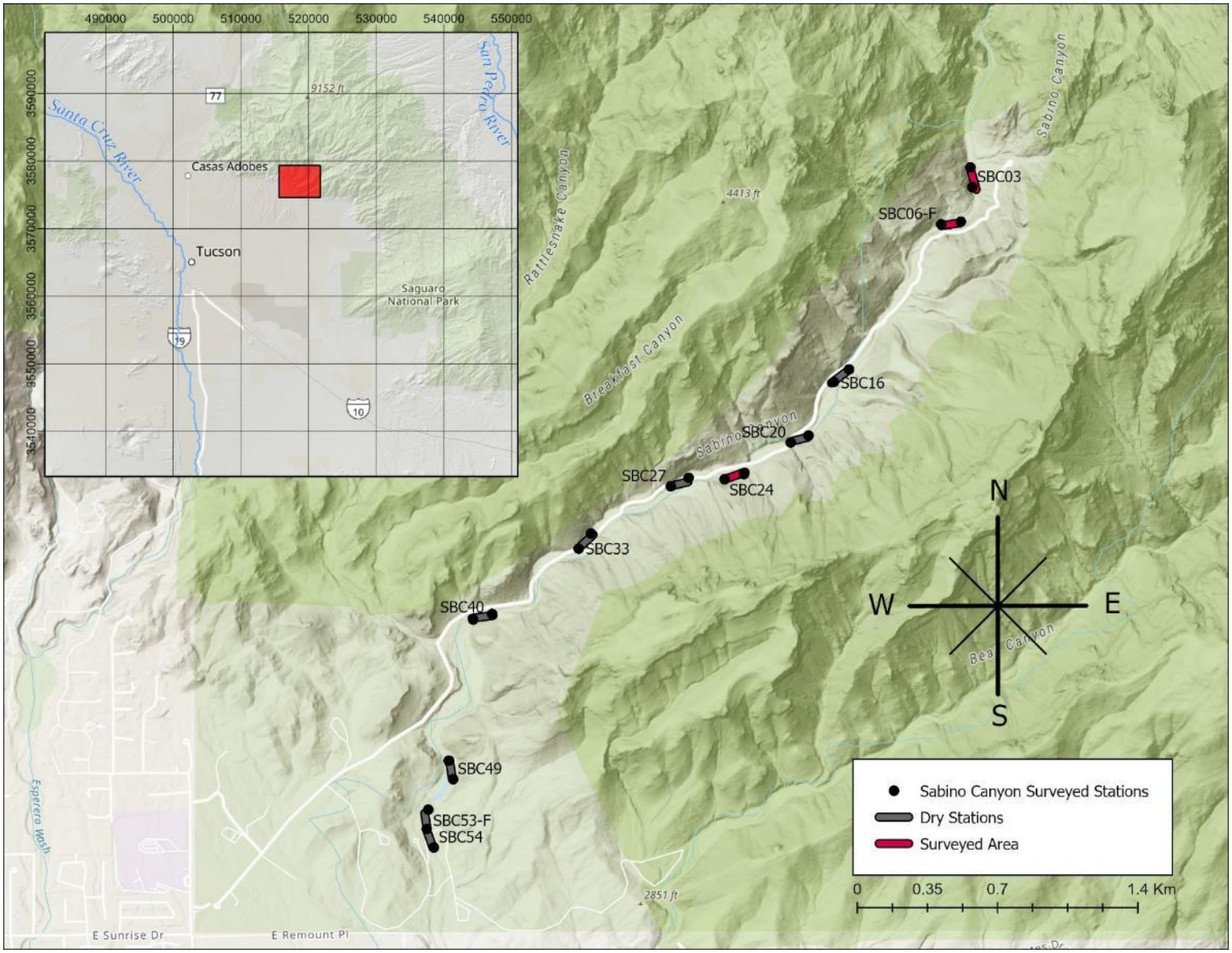

Figure 110. Location of sampled stations at Sabino Canyon, Pima Co., Arizona, November 14, 2024.

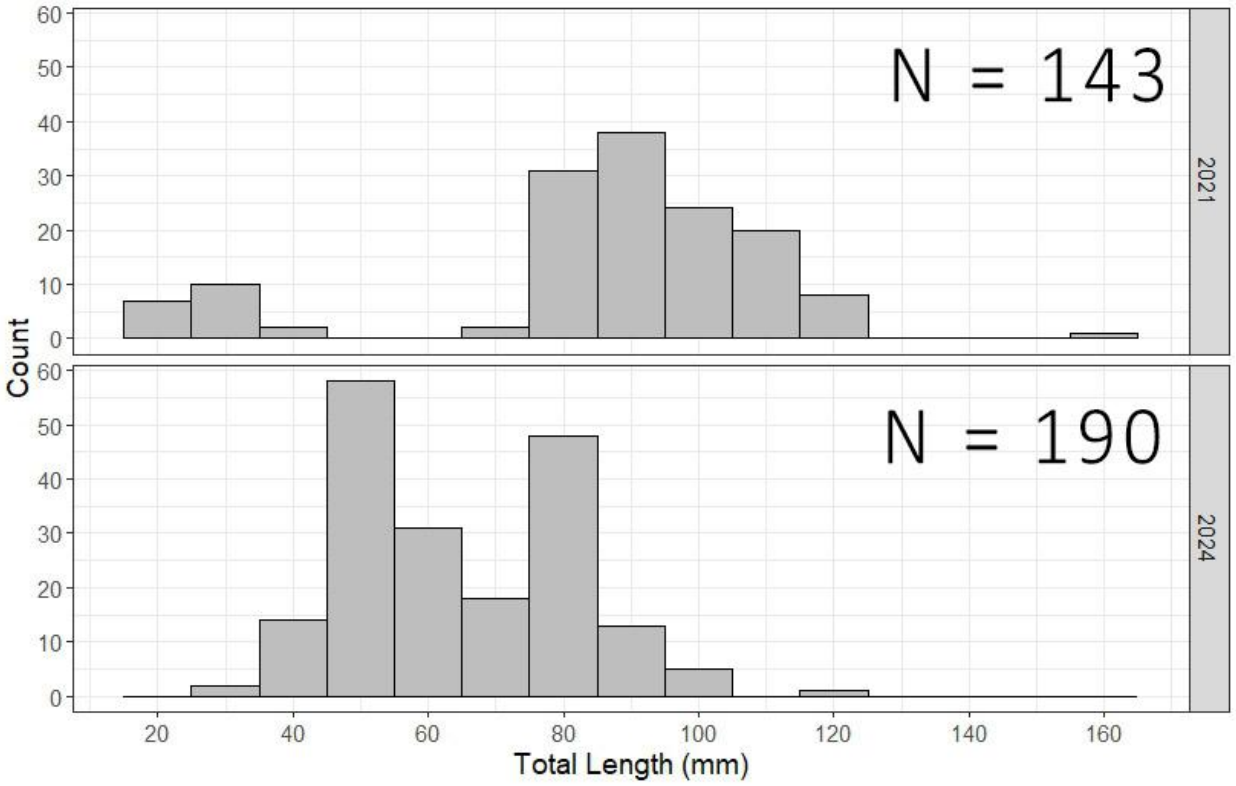

Figure 111. Length-frequency histogram of Gila Chub captured at Sabino Canyon, Pima Co., Arizona, 2021 – 2024.

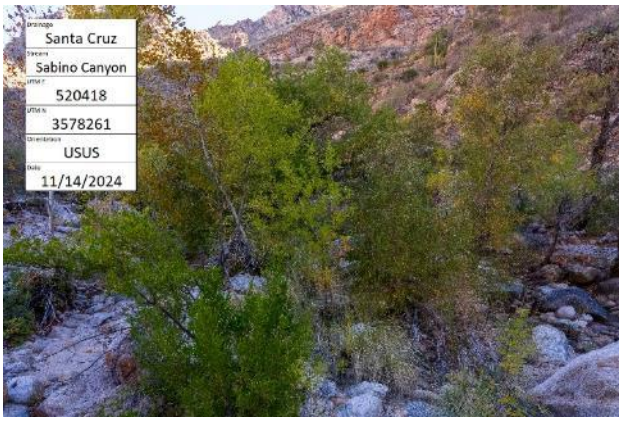

Figure 112. Upstream to upstream view of SBC06-F, Sabino Canyon, Arizona.

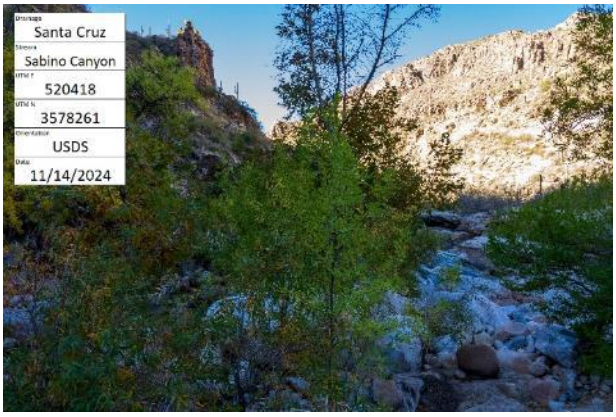

Figure 113. Upstream to downstream view of SBC06-F, Sabino Canyon, Arizona.

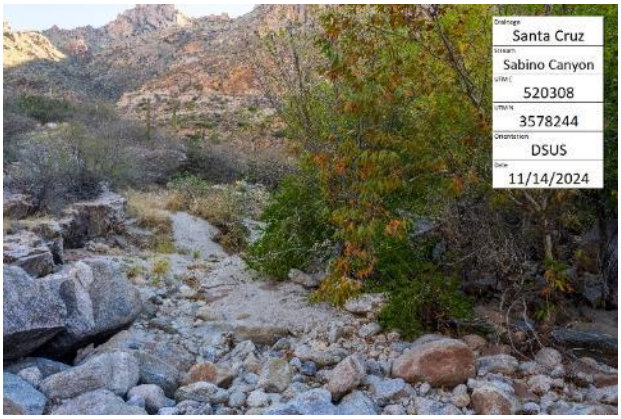

Figure 114. Downstream to upstream view of SBC06-F, Sabino Canyon, Arizona.

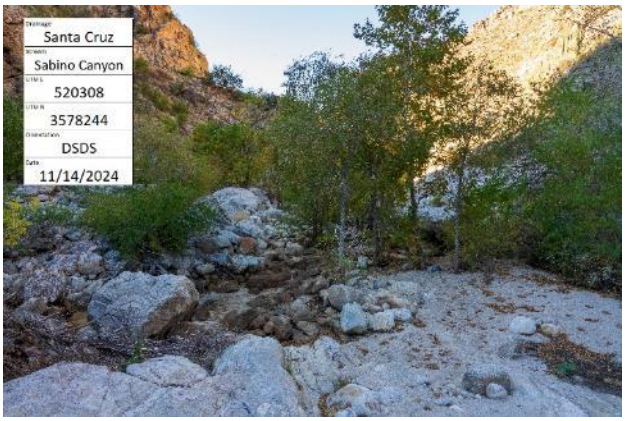

Figure 115. Downstream to downstream view of SBC06-F, Sabino Canyon, Arizona.

Figure 116. Upstream to upstream view of SBC53-F, Sabino Canyon, Arizona.

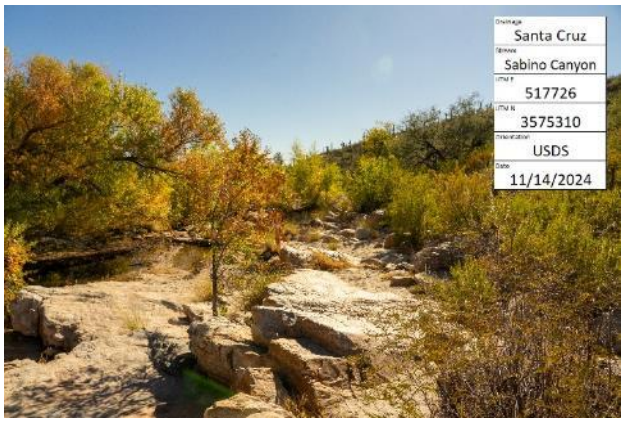

Figure 117. Upstream to downstream view of SBC53-F, Sabino Canyon, Arizona.

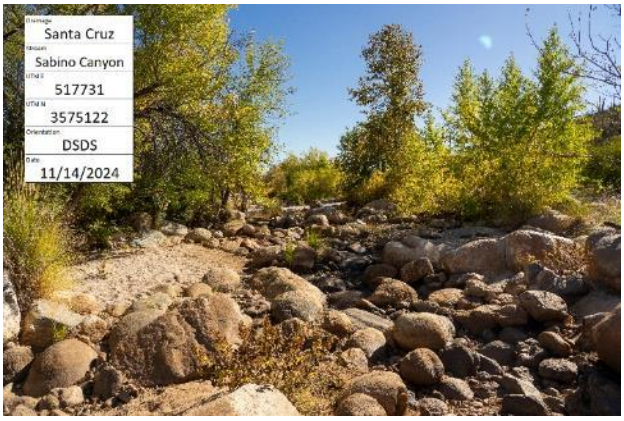

Figure 118. Downstream to downstream view of SBC53-F, Sabino Canyon, Arizona.

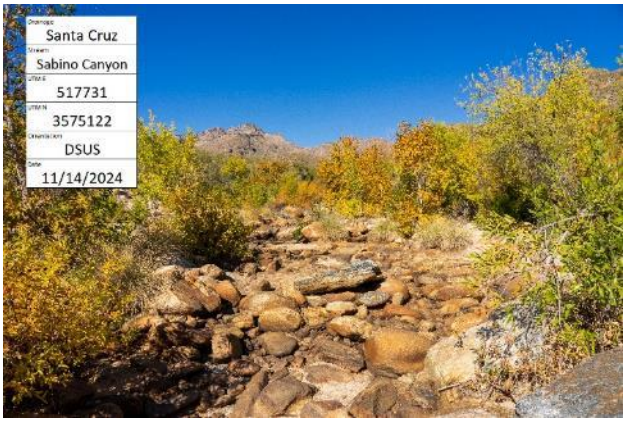

Figure 119. Downstream to upstream view of SBC53-F, Sabino Canyon, Arizona.

Figure 120. Pool located at Sabino falls area within SBC06-F, Sabino Canyon, Arizona.

Upper Gila River Basin

Middle Blue River June 3-6, 2024

Station		Lower Boundary	Upper Boundary
MBR07	12S NAD83	666328E, 3709069N	666266E, 3709130N
MBR12		666434E, 3708652N	666499E, 3708731N
MBR14		666440E, 3708487N	666417E, 3708564N
MBR31		666300E, 3707074N	666350E, 3707124N
MBR33		666252E, 3706913N	666267E, 3706998N
MBR81		668778E, 3704403N	668861E, 3704491N
MBR100		669063E, 3702652N	669057E, 3702730N
MBR106		668810E, 3702190N	668887E, 3702245N
MBR108-F		668664E, 3701972N	668708E, 3702069N
MBR127		668716E, 3700244N	668765E, 3700327N
MBR130		668612E, 3699972N	667644E, 3700076N
MBR150		668152E, 3698253N	668235E, 3698282N
MBR160		667984E, 3697459N	668073E, 3697517N
MBR175		668469E, 3696162N	668497E, 3696248N
MBR182		668610E, 3695661N	668529E, 3695736N
MBR195		669161E, 3694698N	669184E, 3694779N
MBR207-F		669464E, 3693924N	669478E, 3694007N
MBR210		669558E, 3693687N	669539E, 3693775N
MBR219		669501E, 3693098N	669456E, 3693154N
MBR240		668886E, 3691284N	668973E, 3691307N
MBR257		668772E, 3690083N	668907E, 3690136N
MBR266		668640E, 3689269N	668643E, 3689378N

Blue River (Greenlee Co, Arizona) is a tributary of San Francisco River and flows for about 82 km from its origin near Alpine, Arizona. In 2012, a fish barrier was constructed in Blue River about 800 m upstream of its confluence with the San Francisco River to prevent the movement of non-native fish into the system. In 2012, non-native removal and native fish repatriation efforts began in lower Blue River (downstream of Fritz Ranch). Due to successful removal of non-native fish and repatriation of Spikedace and Roundtail Chub *Gila robusta* in lower Blue River, repatriation efforts were continued upstream in 2016 with the stocking of Spikedace and Roundtail Chub downstream of The Box. Due to the remoteness of middle Blue River (McKittrick Creek to Fritz Ranch), few fish surveys have occurred in this section of Blue River. Middle Blue River encompasses about 28 km of river (some flow may go sub-surface) and native species likely to inhabit this reach include Loach Minnow, Spikedace, Roundtail Chub, Sonora Sucker, Desert Sucker, Speckled Dace, and Longfin Dace. This site has not been surveyed under the GRBNFMP. Spikedace and Loach Minnow were the focal species at this site.

M&A personnel completed sampling of middle Blue River June 3-6, 2024. Twenty-two (2 fixed, 20 random) 100-m stations were surveyed via single-pass BPEF with dip nets. The site was accessed via Blue River Road and XXX Ranch Road. A truck was parked at the end of each road and personnel hiked upstream along the river for approximately 31km from XXX Ranch Road to Blue River Road. Private landowner access is required to reach the truck near the end of Blue River Road.

Reach 1 was surveyed June 6, 2024, and extends from McKittrick Creek (666294E, 3709572N) to Strayhorse Creek (666893E, 3706382N; Figure 120). Five stations were surveyed, and capture totals were 14 Loach Minnow, six Spikedace, 291 Speckled Dace, 169 Desert Sucker, 49 Sonora Sucker, 10 Roundtail Chub, and seven Longfin Dace. The two downstream stations in reach 1 (MBR31 and MBR33) were most productive: at MBR33 the most fish were caught of any station in middle Blue River during this effort. The three stations closer to the uppermost extent of the monitoring reach did not yield many fish (Table 20). The habitat changed drastically from deep pools with fast-moving riffles and runs 0.5 m deep and heavy vegetation surrounding the channel at the downstream end of the reach to shallow (0.1 m), slow moving riffles and runs with almost no canopy cover at the upstream end.

Reach 2 was surveyed June 5, 2024, and extends from Strayhorse Creek to HU Bar Box (668483E, 3699568N). Three of six stations were surveyed; three stations (100, 106, and 108-F) were dry at the time of sampling. Capture totals were one Spikedace, 234 Speckled Dace, 225 Desert Sucker, 30 Longfin Dace and 22 Sonora Sucker. Loach Minnow were not detected in reach 2. The river was wetted immediately upstream and downstream of the dry stations.

Reach 3 was surveyed June 4 – 5, 2024 and extends from HU Bar Box to Little Blue Creek (669594E, 3694272N). Five stations were surveyed, and capture totals were three Loach Minnow, two Spikedace, 605 Desert Sucker, 276 Speckled Dace, 119 Longfin Dace, and 22 Sonora Sucker. Other wildlife captured in this reach were two Canyon Tree Frogs and one Black-necked Gartersnake *Thamnophis cyrtopsis*.

Reach 4 was surveyed June 3 – 4, 2024 and extends from Little Blue Creek to XXX Ranch (668633E, 3688685N). Six stations were surveyed, capture totals were three Spikedace, 355 Speckled Dace, 266 Desert Sucker, 178 Longfin Dace, 21 Sonora Sucker, and three Roundtail Chub. Loach Minnow were not detected in reach 4. Station 219 had subsurface flow coming to the surface and expanding downstream at the time of sampling. Many (~100) young-of-year fish and tadpoles were observed moving downstream, but no fish were caught in the station. The river was dry for approximately 600 m downstream of MBR219.

Instream substrate was generally uniform throughout the monitoring reaches, consisting of slightly embedded cobble and pebble covered with a characteristic, slick diatomaceous film. However, the riparian soil surrounding the channel was variable depending on floodplain width. In areas where the floodplain was wide (≥ 500 m) the soil was sandy and dry, and inhabited by creosote bush. The channel appeared to be shifting in these areas and sinuosity was regular and low (1.06 - 1.3). In contrast, where the floodplain was narrow (≤ 500 m) the soil was moist and loamy, and inhabited by typical riparian trees such as cottonwood, sycamore, ash, and willow.

Water temperature, DO, pH, and conductivity were taken at one fixed station (MBR207-F) and were measured at 23.2°C, 10.3 mg/L, 8.76, and 611µS, respectively. Photographs of upper and lower extents of fixed station MBR108-F are provided below (Figures 122-125).

Table 20. Summary of catch by BPEF at middle Blue River, Greenlee Co., Arizona, surveyed June 3-6, 2024. Total effort was 14,773 seconds.

Reach	Stations	Statistic	TICO	MEFU	AGCH	GIRO	CAIN	PACL	RHOS	Totals
1 (4,163 sec)	MBR07 MBR12 MBR14 MBR31 MBR33	Count	14	6	7	10	49	169	291	546
		% total catch	2.56%	1.10%	1.28%	1.83%	8.97%	30.95%	53.30%	100.00%
		CPUE (ind/hr)	12.10665	5.188566	6.053327	8.64761	42.37329	146.1446	251.6454	472.1595
2 (1,902 sec)	MBR81 MBR100 MBR106 MBR108-F MBR127 MBR130	Count	0	1	30	0	22	225	234	512
		% total catch	0.00%	0.20%	5.86%	0.00%	4.30%	43.95%	45.70%	100.00%
		CPUE (ind/hr)	0	1.892744	56.78233	0	41.64038	425.8675	442.9022	969.0852
3 (3,435 sec)	MBR150 MBR160 MBR175 MBR182 MBR195	Count	3	2	119	0	22	605	276	1,027
		% total catch	0.29%	0.19%	11.59%	0.00%	2.14%	58.91%	26.87%	100.00%
		CPUE (ind/hr)	3.14	2.10	124.72	0.00	23.06	634.06	289.26	1076.33
4 (5,273 sec)	MBR207-F MBR210 MBR219 MBR240 MBR257 MBR266	Count	0	3	178	3	21	266	355	826
		% total catch	0.00%	0.36%	21.55%	0.36%	2.54%	32.20%	42.98%	100.00%
		CPUE (ind/hr)	0.00	2.05	121.52	2.05	14.34	181.60	242.37	563.93
Total		Count	17	12	334	13	114	1,265	1,156	2,911
		% total catch	0.58%	0.41%	11.47%	0.45%	3.92%	43.46%	39.71%	100.00%
		CPUE (ind/hr)	4.14	2.92	81.39	3.17	27.78	308.27	281.70	709.38

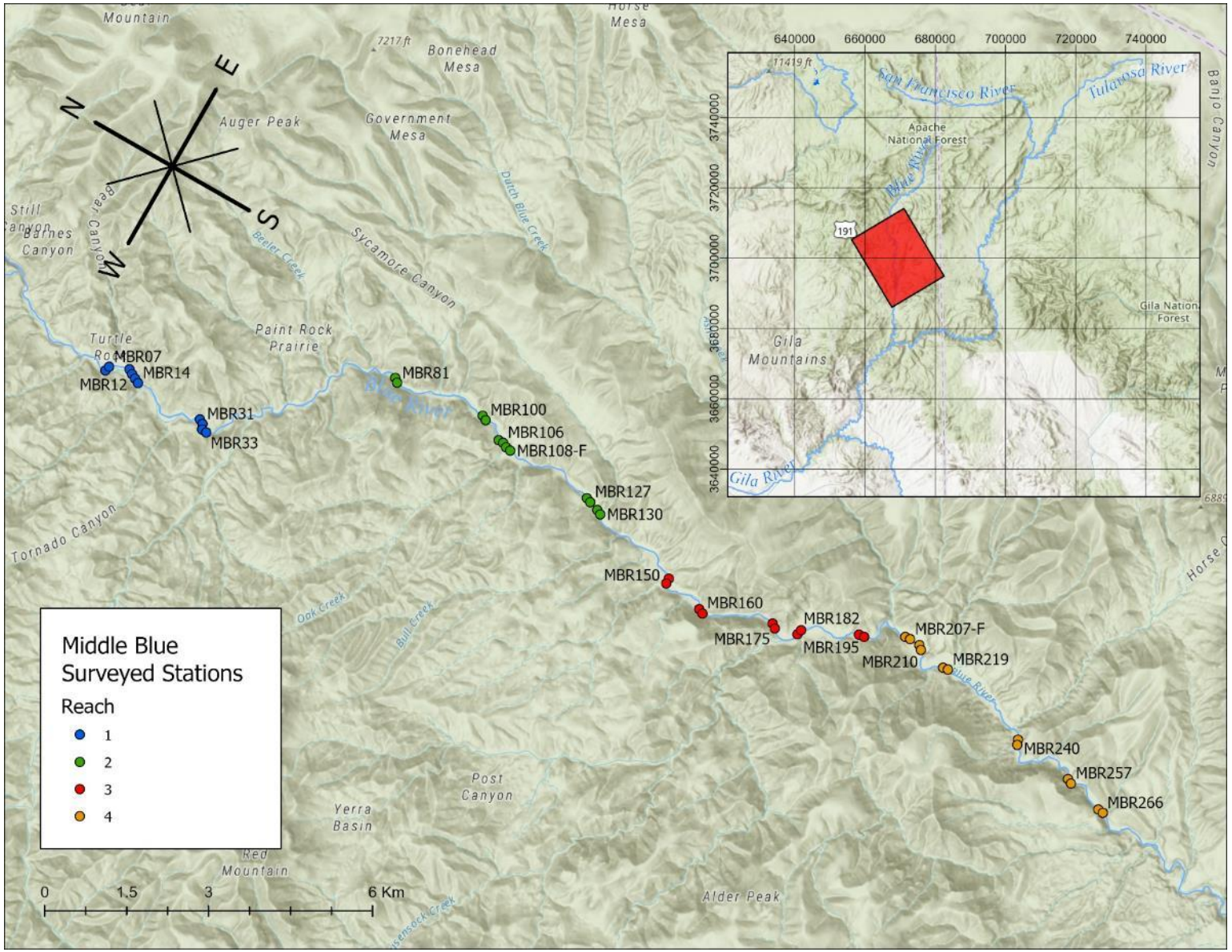

Figure 121. Location of sampled stations at middle Blue Creek, Greenlee Co., Arizona, surveyed June 3-6, 2024.

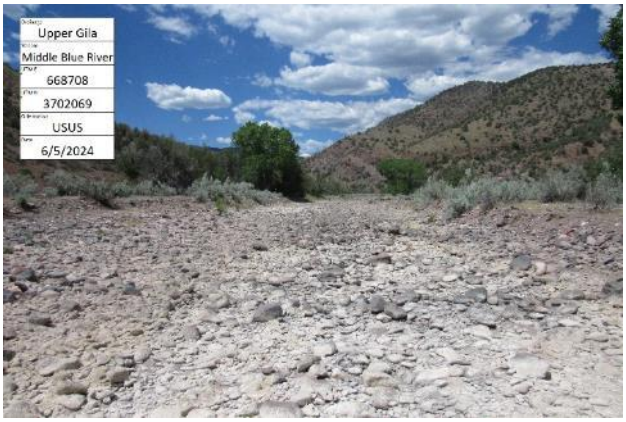

Figure 122. Upstream to upstream view of MBR108-F, middle Blue River, Arizona.

Figure 123. Upstream to downstream view of MBR108-F, middle Blue River, Arizona.

Figure 124. Downstream to upstream view of MBR108-F, middle Blue River, Arizona.

Figure 125. Downstream to downstream view of MBR108-F, middle Blue River, Arizona.

KP Creek August 5, 2024

Station		Lower Boundary	Upper Boundary
KPC16	12S NAD83	665256E, 3713502N	665199E, 3713567N
KPC20		665445E, 3713222N	665390E, 3713308N
KPC25-F		665723E, 3712928N	665681E, 3712983N
KPC36		666860E, 3711534N	666799E, 3711619N

KP Creek (Greenlee Co., Arizona) is tributary to Blue River and is located in Apache Sitgreaves NF. Loach Minnow was the focal species of this site. In 2017 and 2019, eDNA samples were collected in lower KP Creek as part of a Loach Minnow and Spikedace range-wide eDNA study. Loach Minnow eDNA was detected at 100-m and 2,000-m above KP's confluence with the Blue River (Mosher et al. 2020). This is the second survey conducted consecutively under the GRBNFMP. The survey conducted in 2023 resulted in no detection or capture of Loach Minnow.

KP Creek was surveyed on August 5, 2024. Four 100-m stations (1 fixed, 3 random) were surveyed by backpack electrofishing. The upper stations of the creek were accessed via Blue River Road until private property boundaries were met. Personnel then hiked upstream through private property, with permission, to stations KPC16, KPC20, and KPC25-F. The most downstream station, KPC36, was accessed from Blue River Road just beyond the creek crossing (Figure 126).

Totals of 197 Speckled Dace, 43 Desert Sucker, 14 Brown Trout *Salmo trutta*, six Sonora Sucker, and two Longfin Dace were captured (Table 21). Loach Minnow were not captured or observed at KP Creek. Brown Trout were encountered at all but the fixed station. Most (57%) of the Brown Trout sampled were in the 51-100 mm size-class. Total length varied from 65-291 mm. The last survey conducted (2023) at this site resulted in the capture of 13 Brown Trout. Northern Crayfish were observed in the most downstream station (KPC36). A Black-tailed Rattlesnake *Crotalus molossus* was observed on boulders while sampling the fixed station.

Sediment in the streambed appeared to be mostly highly embedded cobble and large gravel, not conducive to Loach Minnow habitat. Mesohabitat consisted of long, shallow riffles separated by short 1-m deep pools. The upper station (KPC16) consisted of a series of short step-runs ~0.5m deep. Upon arrival for sampling, the stream was noticeably more turbid than experienced in 2023. This is likely due to seasonal monsoonal flooding. Turbidity did subside as personnel continued to hike upstream. Stream discharge at KPC25-F and was calculated at 0.051 m^3 (1.8 cfs). Water temperature, DO, pH, and conductivity were 21.4 °C, 9.5 mg/L, 8.26, and 237 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 127-128).

This is the second survey in as many years sampling KP Creek. Loach Minnow were not detected in either survey. Sediment in the stream does not appear to be conducive to Loach Minnow habitat at this time but may improve in the future if the stream evolves geomorphologically.

Table 21. Summary of catch by BPEF at KP Creek, Greenlee Co., Arizona, surveyed August 5, 2024. Total effort was 3,549 seconds.

Stations	Statistic	RHOS	PACL	SATR	CAIN	AGCH	Totals
KPC16 (901 sec)	Count	64	0	12	0	0	76
	% total catch	84.21%	0.00%	15.79%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	255.7159	0	47.94673	0	0	303.6626
KPC20 (1,031 sec)	Count	54	29	1	0	0	84
	% total catch	64.29%	34.52%	1.19%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	188.5548	101.2609	3.491756	0	0	293.3075
KPC 25-F (590 sec)	Count	7	0	0	0	0	7
	% total catch	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	42.71	0.00	0.00	0.00	0.00	42.71
KPC36 (1,027 sec)	Count	72	14	1	6	2	95
	% total catch	75.79%	14.74%	1.05%	6.32%	2.11%	100.00%
	CPUE (ind/hr)	252.39	49.07	3.51	21.03	7.01	333.01
	Count	197	43	14	6	2	262
	% total catch	75.19%	16.41%	5.34%	2.29%	0.76%	100.00%
	CPUE (ind/hr)	199.83	43.62	14.20	6.09	2.03	265.77

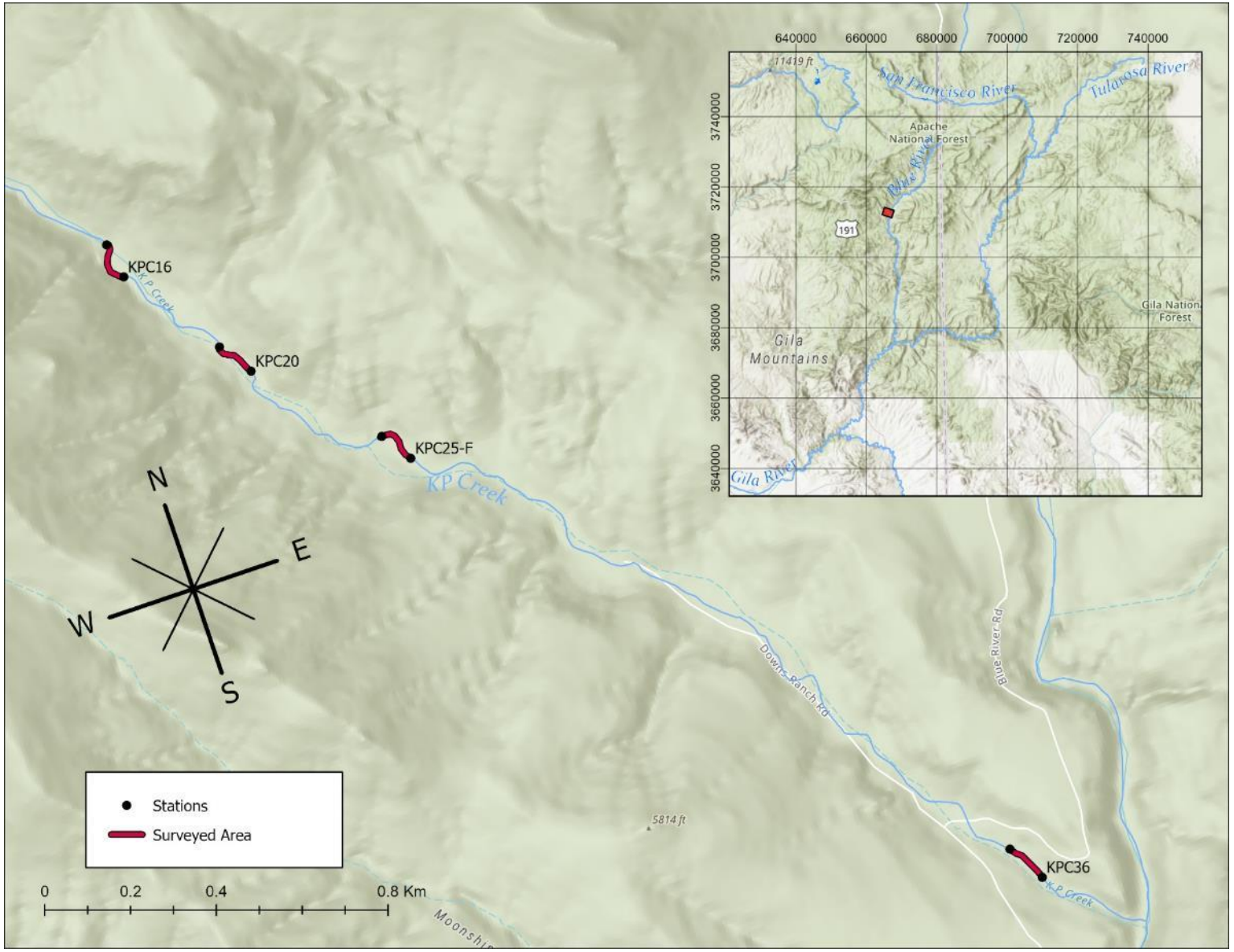

Figure 126. Location of sampled stations at KP Creek, Greenlee Co., Arizona, surveyed August 5, 2024.

Figure 127. Downstream to upstream view of KPC25-F, KP Creek, Arizona.

Figure 128. Downstream to downstream view of KPC25-F, KP Creek, Arizona.

Grant Creek August 6, 2024

Station		Lower Boundary	Upper Boundary
GRC16	12S NAD83	665737E, 3719963N	665661E, 3719997N
GRC19		665915E, 3719760N	665878E, 3719837N
GRC33		666767E, 3718873N	666718E, 3718956N
GRC40		667234E, 3718406N	667156E, 3718469N
GRC61-F		668186E, 3716762N	668122E, 3716838N
GRC63		668274E, 3716616N	668216E, 3716689N
GRC74		669073E, 3716108N	668984E, 3716117N

Grant Creek (Greenlee Co., Arizona) is a tributary to Blue River and flows 16 km from its origin near Hannagan Meadow. The focal species for this site was Loach Minnow. In 2017, eDNA sampling detected Loach Minnow in Grant Creek at 100, 600, 1,000, and 2,000 m upstream of its confluence with the Blue River. Loach Minnow presence was confirmed later that year during backpack electrofishing surveys. Grant Creek was surveyed in 2023 and Loach Minnow was not detected or observed.

Grant Creek was surveyed on August 6, 2024. Seven (1 fixed, 6 random), 100-m stations were surveyed with backpack electrofishing (Figure 130). Stations were accessed via hiking Grant Creek Trail #75 from Blue River Road near the confluence with Blue River. The trail veered north toward White Oak Spring, off course with the creek, 5 km upstream of where the trail began. The hiking off trail was mainly bushwacking in a narrow canyon to a natural barrier another 2 km upstream.

Totals of 251 Speckled Dace, 76 hybrid Apache × Rainbow Trout *Oncorhynchus apache*, five Desert Sucker, and one Sonora Sucker (Table 22) were captured. Loach Minnow were not captured or observed at Grant Creek. From the confluence of Blue River, the stream mainly consisted of shallow slow-moving riffles for approximately 5 km, before turning into a canyon with 6-m high walls, thick overhanging vegetation, and shallow riffles separated by 1.5-m step pools formed by woody debris. The catch at two stations (GRC16, GRC19) following this change in habitat was comprised of 71.4% (n=70) Apache × Rainbow Trout and 28.6% (n=28) Speckled Dace, whereas downstream of this change, catch comprised of 94.9% Speckled Dace (n=223), 2.6% Apache Trout (n=6), 2.1% Desert Sucker (n=5), and 0.4% Sonora Sucker (n=1). A similar pattern was observed in 2023's survey, but to a lesser extent when more Desert and Sonora Suckers were encountered downstream. Upstream of the confluence, fish were not captured in the first three stations sampled. A Gophersnake *Pituophis catenifer* and Black-tailed Rattlesnake were encountered on the trail while hiking Grant Creek.

A length-frequency histogram of the hybrid Apache x Rainbow Trout sample supports a strong presence of sexually mature fish and abundant recruitment in consecutive years (Figure 129). Water temperature at Grant Creek is 7 degrees cooler than its neighboring stream KP Creek, this may contribute to the success of the Apache Trout population encountered during this survey.

Stream discharge measured at the fixed station (GRC61-F) was 0.036 m^3 (1.29 cfs). Water temperature, DO, pH, and conductivity were 16.7 °C, 5.5 mg/L, 8.39, and 276 µS, respectively. Photographs of upper and lower extents at one fixed station are provided below (Figures 131-134).

Table 22. Summary of catch by BPEF at Grant Creek, Greenlee Co., Arizona, surveyed on August 6, 2024. Total effort was 4,450 seconds.

Stations	Statistic	RHOS	ONAP	PACL	CAIN	Totals
GRC16 (581 sec)	Count	0	41	0	0	41
	% total catch	0.00%	100.00%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	0	143.162	0	0	143.162
GRC19 (645 sec)	Count	28	29	0	0	57
	% total catch	49.12%	50.88%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	156.2791	161.8605	0	0	318.1395
GRC33 (868 sec)	Count	142	4	5	1	152
	% total catch	93.42%	2.63%	3.29%	0.66%	100.00%
	CPUE (ind/hr)	588.94	16.59	20.74	4.15	630.41
GRC40 (907 sec)	Count	81	2	0	0	83
	% total catch	97.59%	2.41%	0.00%	0.00%	100.00%
	CPUE (ind/hr)	321.50	7.94	0.00	0.00	329.44
GRC61-F (511 sec)	Count	0	0	0	0	0
	% total catch	0.00%	0.00%	0.00%	0.00%	0.00%
	CPUE (ind/hr)	0.00	0.00	0.00	0.00	0.00
GRC63 (516 sec)	Count	0	0	0	0	0
	% total catch	0.00%	0.00%	0.00%	0.00%	0.00%
	CPUE (ind/hr)	0.00	0.00	0.00	0.00	0.00
GRC74 (422 sec)	Count	0	0	0	0	0
	% total catch	0.00%	0.00%	0.00%	0.00%	0.00%
	CPUE (ind/hr)	0.00	0.00	0.00	0.00	0.00
	Count	251	76	5	1	333
	% total catch	75.38%	22.82%	1.50%	0.30%	100.00%
	CPUE (ind/hr)	203.06	61.48	4.04	0.81	269.39

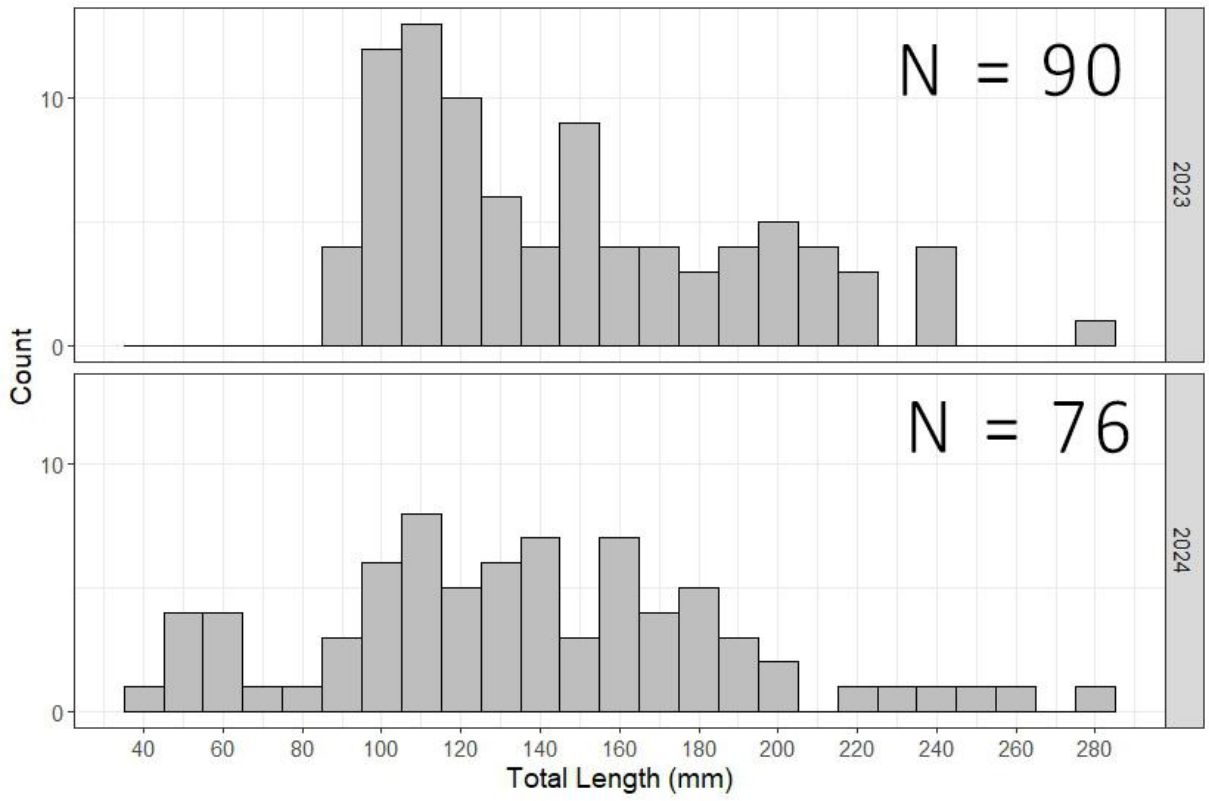

Figure 129. Length-frequency histogram of Apache Trout captured at Grant Creek, Greenlee Co., Arizona, surveyed 2023 and 2024. Total number of Apache Trout captured is denoted in the upper right of each survey year.

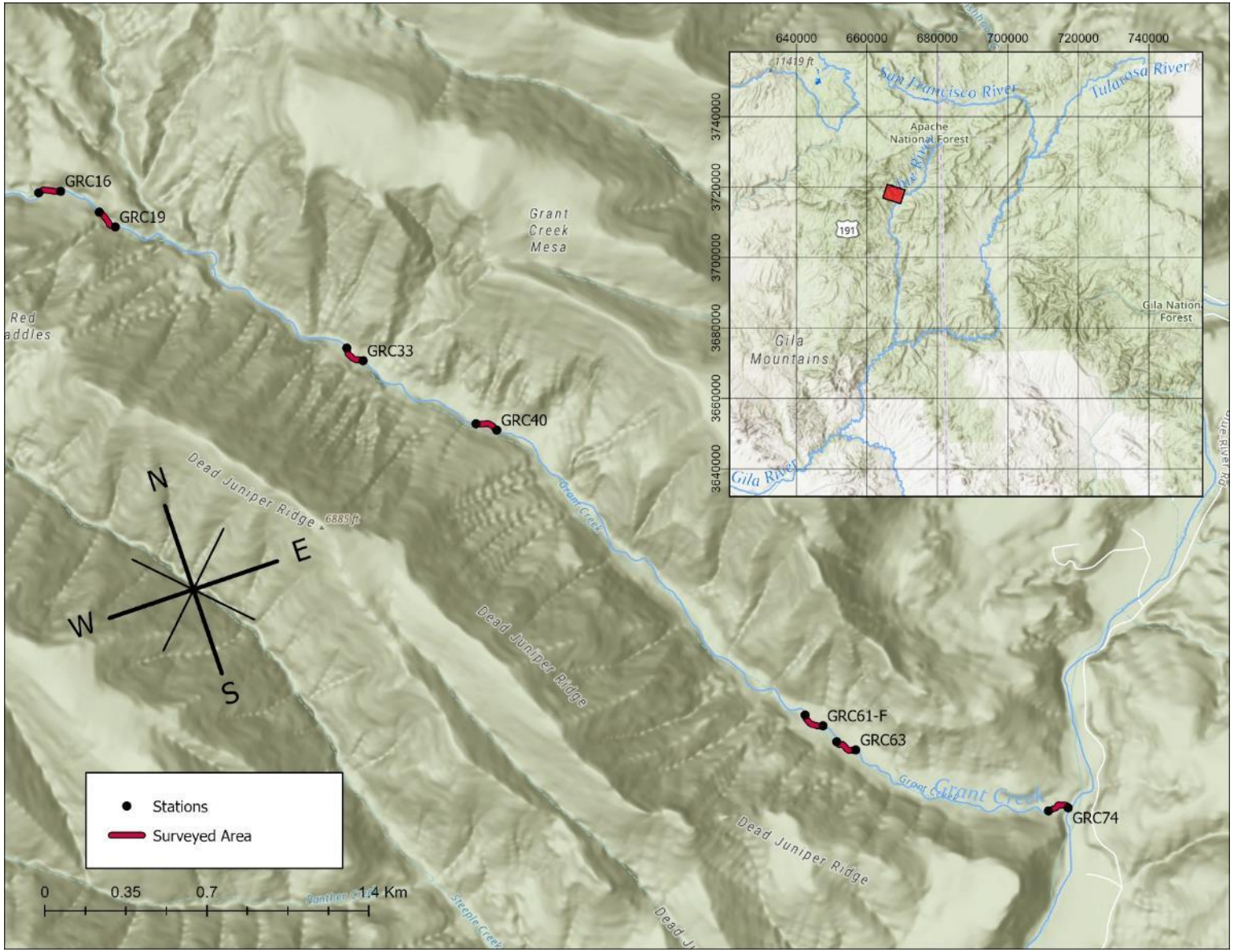

Figure 130. Location of sampled stations at Grant Creek, Greenlee Co., Arizona, surveyed August 6, 2024.

Figure 131. Upstream to upstream view of GRC61-F, Grant Creek, Arizona.

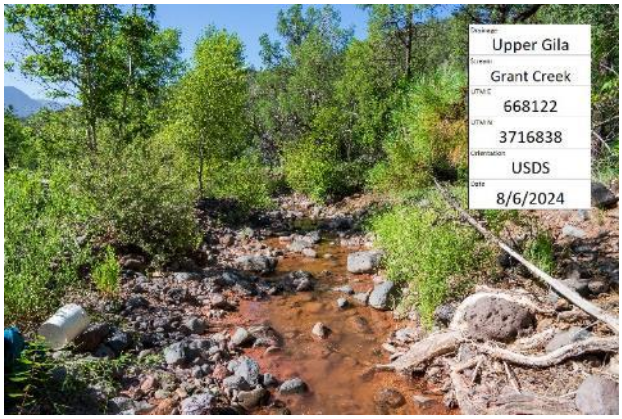

Figure 132. Upstream to downstream view of GRC61-F, Grant Creek, Arizona.

Figure 133. Downstream to upstream view of GRC61-F, Grant Creek, Arizona.

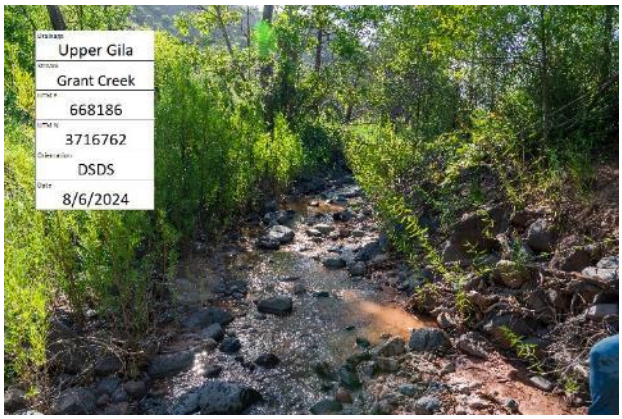

Figure 134. Downstream to downstream view of GRC61-F, Grant Creek, Arizona.

Harden Cienega September 10, 2024

Station		Lower Boundary	Upper Boundary
HCC18	12S NAD83	675587E, 3674329N	675608E, 3674244N
HCC27-F		674792E, 3674580N	674867E, 3674569N
HCC29		674639E, 3674621N	674747E, 3674600N

Harden Cienega Creek, Greenlee Co., is a tributary of the San Francisco River located about 22.5 km northeast of Clifton, Arizona. Harden Cienega Creek flows for about 4.4 km from Prospect Draw. Harden Cienega Creek contains wild populations of Gila Chub, Sonora Sucker, Desert Sucker, Speckled Dace, and Longfin Dace. Gila Chub were translocated further upstream above a large waterfall in 2015 to expand their distribution. Gila Topminnow was introduced to lower Harden Cienega Creek in 2019; however, they have failed to be detected in five consecutive years of monitoring. Green Sunfish were present at Harden Cienega Creek and mechanical removal efforts last took place in 2024. Gila Chub was the focal species at this site and this site has not been surveyed under GRBNFMP.

M&A personnel surveyed Harden Cienega Creek September 10, 2024. Three 100-m stations (1 fixed, 2 random) were surveyed via backpack electrofishing. Harden Cienega Creek was accessed by hiking upstream San Francisco River from Frisco Camp ~2.7 km before reaching the confluence (Figure 135).

Totals of 69 Gila Chub, 393 Desert Sucker, 125 Speckled Dace, 48 Sonora Sucker, and 14 Longfin Dace were captured (Table 23). Gila Topminnow were not observed or detected at this site. A length-frequency histogram (Figure 136) of Gila Chub captured from this population indicates strong recruitment with 54 of the 69 individuals captured measuring shorter than 100 mm.

Harden Cienega Creek appeared to be wetted all the way to the confluence with the San Francisco River. The stream turns into a narrow canyon with 20-m high walls around station HCC22. Pools became difficult to traverse with a backpack-electrofisher but were doable until reaching HCC11 where a 2-m high waterfall was encountered. Personnel were unable to sample the last 100-m station located upstream of this feature. Personnel observed Gila Chub occurring in abundance (>100 individuals) in deep, slick-rock pools.

Stream discharge measured at the fixed station (HCC27-F) was 0.031 m^3 (1.07 cfs). Water temperature, pH, and conductivity were 20.4 °C, 8.35, and 246 µS, respectively. Photographs of upper and lower extents at one fixed station are provided below (Figures 137-140).

Table 23. Summary of Catch by BPEF at Harden Cienega Creek, Greenlee Co., Arizona, surveyed September 10, 2024. Total effort was 2,447 seconds.

Stations	Statistic	GIIN	AGCH	CAIN	PACL	RHOS	Totals
HCC18 (849 sec)	Count	34	4	4	100	22	164
	% total catch	20.73%	2.44%	2.44%	60.98%	13.41%	100.00%
	CPUE (ind/hr)	144.1696	16.96113	16.96113	424.0283	93.28622	695.4064
HCC27-F (790 sec)	Count	22	5	31	150	58	266
	% total catch	8.27%	1.88%	11.65%	56.39%	21.80%	100.00%
	CPUE (ind/hr)	100.2532	22.78481	141.2658	683.5443	264.3038	1212.152
HCC29 (808 sec)	Count	13	5	13	143	45	219
	% total catch	5.94%	2.28%	5.94%	65.30%	20.55%	100.00%
	CPUE (ind/hr)	57.92	22.28	57.92	637.13	200.50	975.74
	Count	69	14	48	393	125	649
	% total catch	10.63%	2.16%	7.40%	60.55%	19.26%	100.00%
	CPUE (ind/hr)	101.51	20.60	70.62	578.18	183.90	954.80

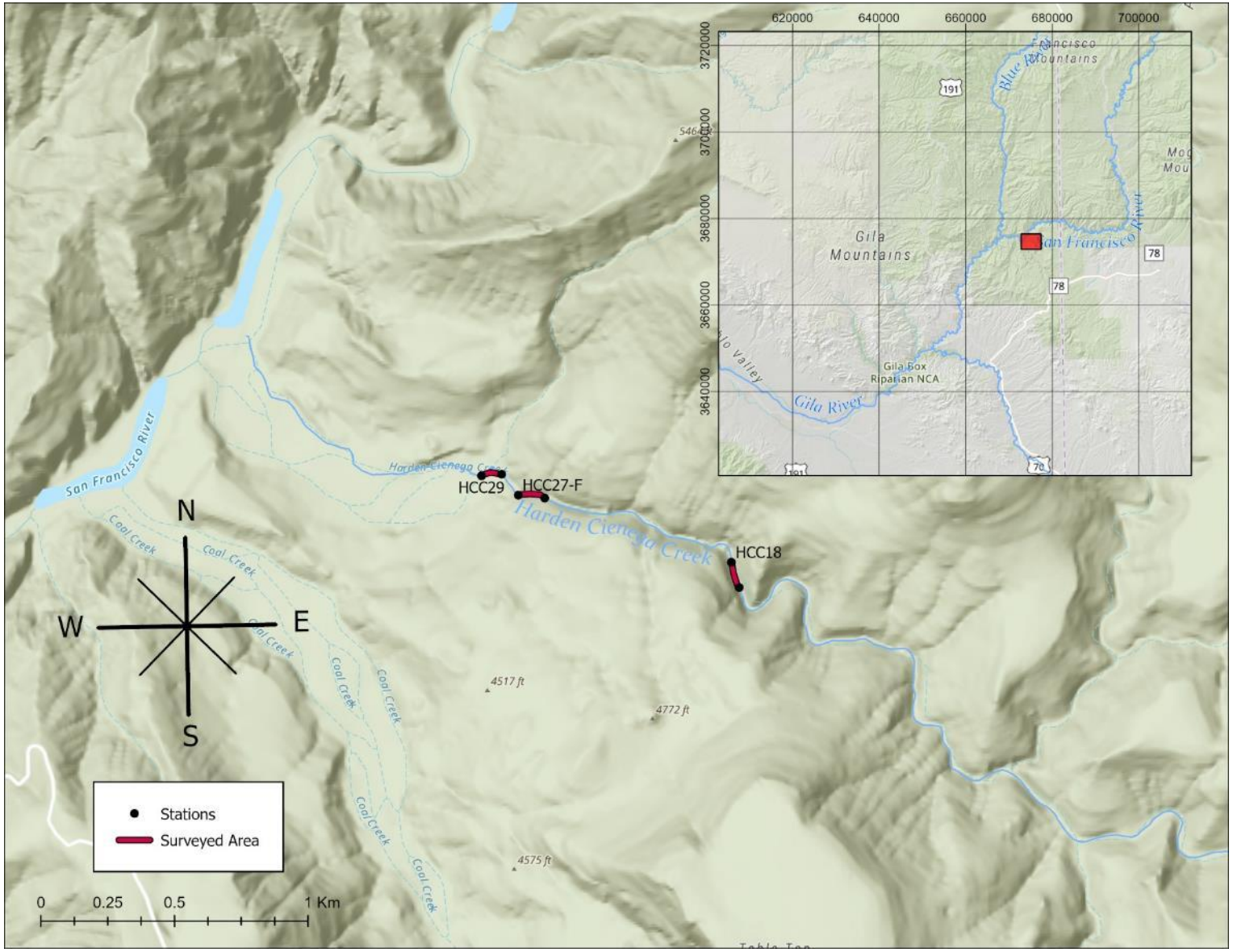

Figure 135. Location of sampled stations at Harden Cienega Creek, Greenlee Co., Arizona, surveyed September 10, 2024.

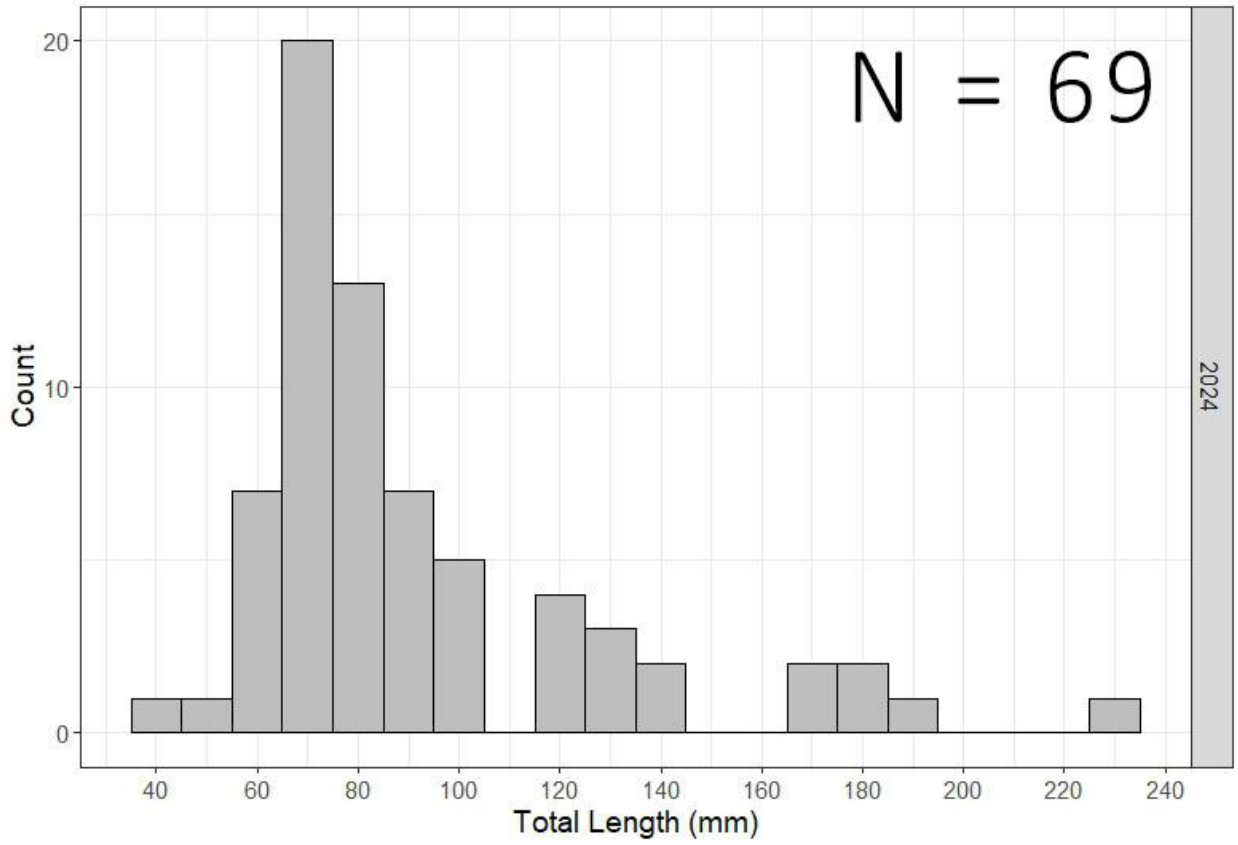

Figure 136. Length-frequency histogram of Gila Chub captured at Harden Cienega Creek, Greenlee Co., Arizona, surveyed September 10, 2024.

Figure 137. Upstream to upstream view of HCC27-F, Harden Cienega Creek, Arizona.

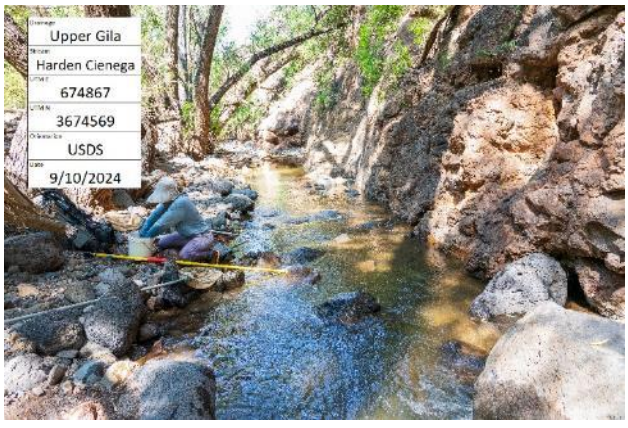

Figure 138. Upstream to downstream view of HCC27-F, Harden Cienega Creek, Arizona.

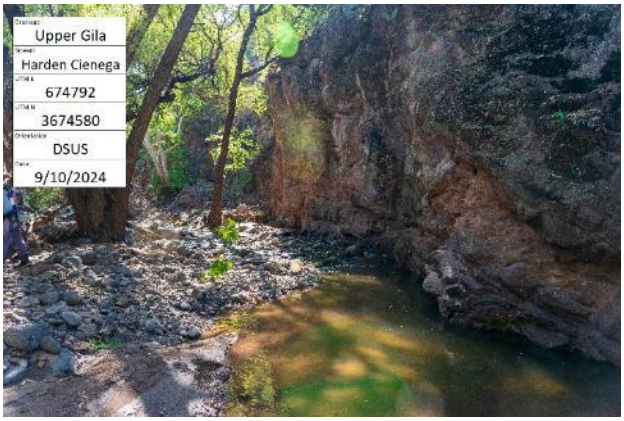

Figure 139. Downstream to upstream view of HCC27-F, Harden Cienega Creek, Arizona.

Figure 140. Downstream to downstream view of HCC27-F, Harden Cienega Creek, Arizona.

Dix Creek September 9 -11, 2024

Station		Lower Boundary	Upper Boundary
DXC09	12S NAD83	672906E, 3672425N	672973E, 3672350N
DXC10		672841E, 3672489N	672908E, 3672424N
DXC13		672689E, 3672736N	672690E, 3672658N
DXC14		672633E, 3672773N	672689E, 3672736N
DXC15		672557E, 3672707N	672634E, 3672780N
DXC22		672114E, 3673036N	672161E, 3672982N
DXC31		671523E, 3673085N	671472E, 3673048N
DXC35		671624E, 3673427N	671622E, 3673334N
DXC38-F		671793E, 3673566N	671779E, 3673480N
DXC41		671750E, 3673828N	671782E, 3673753N
DXC46		671721E, 3674302N	671706E, 3674194N

Dix Creek (Greenlee Co., AZ) is in Apache-Sitgreaves National Forest approximately 80 km northeast of Safford, AZ in the Upper Gila sub-basin. Dix Creek originates at the confluence of Left Prong Dix Creek and Right Prong Dix Creek and flows north to its confluence with the San Francisco River. The fish assemblage in Dix Creek is entirely native and the stream supports a natural Gila Chub population. Gila Chub was the focal species for this site. Dix Creek was last surveyed for GRBMP in 2018 and 2021, resulting in the capture of 75 and 83 Gila Chub, respectively (Shollenberger et al. 2022).

M&A personnel completed sampling at Dix Creek August 19, 2024, and September 9-11, 2024. M&A personnel had to leave the first sampling effort and returned in early September. Sampling was completed by BPEF with dip nets. A total of 11 (1 fixed, 10 random) 100-m stations were surveyed (Figure 142). The three most downstream stations were accessed by hiking upstream from Martinez Ranch Road. Remaining stations were accessed by parking along FSR-215 (Rattlesnake Road) and hiking into the right or left prongs of Dix Creek.

Across all surveyed stations 253 Gila Chub, 289 Desert Sucker, 211 Speckled Dace, 45 Longfin Dace, and six Sonora Sucker were captured. Gila Chub were detected at all but station DXC22. This station was immediately upstream of the road crossing with FSR-215 and was dry for most of the station with exception of three empty shallow pools. A length-frequency histogram (Figure 141) indicates strong recruitment in this population, over 72% (n=183) measuring shorter than 100mm. A summary table of all fish captured at Dix Creek is provided below (Table 24).

Gila Chub abundance was homogenous throughout the survey reach despite several natural barriers in the form of waterfalls occurring in Right Prong. Personnel did not traverse said feature in 2021, which may explain the difference in catch totals from the previous survey. Caution should be taken when climbing along the edges of the canyon located at UTM 672557E/3672707N.

Stream discharge was measured at the downstream boundary of DXC38-F and calculated to be 0.014 m3/s (0.51 cfs). Water temperature, dissolved oxygen, pH, and conductivity at the fixed station were 24.0 °C, 6.6 mg/L, 8.22, and 289 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 143-146).

Table 24. Catch summary table of fish captured by BPEF at Dix Creek, Greenlee Co., Arizona, surveyed September 9-11, 2024. Total effort was 5,766 seconds.

Stations	Statistic	GIIN	AGCH	CAIN	PACL	RHOS	Totals
DXC09 (462 sec)	Count	57	0	0	0	6	63
	% total catch	90.48%	0.00%	0.00%	0.00%	9.52%	100.00%
	CPUE (ind/hr)	444.1558	0	0	0	46.75325	490.9091
DXC10 (433 sec)	Count	46	0	0	0	12	58
	% total catch	79.31%	0.00%	0.00%	0.00%	20.69%	100.00%
	CPUE (ind/hr)	382.448	0	0	0	99.76905	482.2171
DXC13 (378 sec)	Count	4	0	0	0	37	41
	% total catch	9.76%	0.00%	0.00%	0.00%	90.24%	100.00%
	CPUE (ind/hr)	38.10	0.00	0.00	0.00	352.38	390.48
DXC14 (360 sec)	Count	30	0	0	0	31	61
	% total catch	49.18%	0.00%	0.00%	0.00%	50.82%	100.00%
	CPUE (ind/hr)	300.00	0.00	0.00	0.00	310.00	610.00
DXC15 (396 sec)	Count	18	0	0	0	70	88
	% total catch	20.45%	0.00%	0.00%	0.00%	79.55%	100.00%
	CPUE (ind/hr)	163.64	0.00	0.00	0.00	636.36	800.00
DXC22 (85 sec)	Count	0	0	0	0	0	0
	% total catch	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CPUE (ind/hr)	0	0	0	0	0	0
DXC31 (504 sec)	Count	34	34	1	0	48	117
	% total catch	29.06%	29.06%	0.85%	0.00%	41.03%	100.00%
	CPUE (ind/hr)	242.86	242.86	7.14	0.00	342.86	835.71
DXC35 (789 sec)	Count	22	192	13	21	89	337
	% total catch	6.53%	56.97%	3.86%	6.23%	26.41%	100.00%
	CPUE (ind/hr)	100.38	876.05	59.32	95.82	406.08	1537.64
DXC38-F (664 sec)	Count	26	2	0	45	0	73
	% total catch	35.62%	2.74%	0.00%	61.64%	0.00%	100.00%
	CPUE (ind/hr)	140.96	10.84	0.00	243.98	0.00	395.78
DXC41 (767 sec)	Count	13	18	0	211	16	258
	% total catch	5.04%	6.98%	0.00%	81.78%	6.20%	100.00%
	CPUE (ind/hr)	61.02	84.49	0.00	990.35	75.10	1210.95
DXC46 (928 sec)	Count	3	44	6	78	39	170
	% total catch	1.76%	25.88%	3.53%	45.88%	22.94%	100.00%
	CPUE (ind/hr)	11.64	170.69	23.28	302.59	151.29	659.48
	Count	253	62	6	289	211	1266
	% total catch	13.51%	4.90%	0.47%	22.83%	16.67%	100.00%
	CPUE (ind/hr)	106.76	38.71	3.75	180.44	131.74	790.43

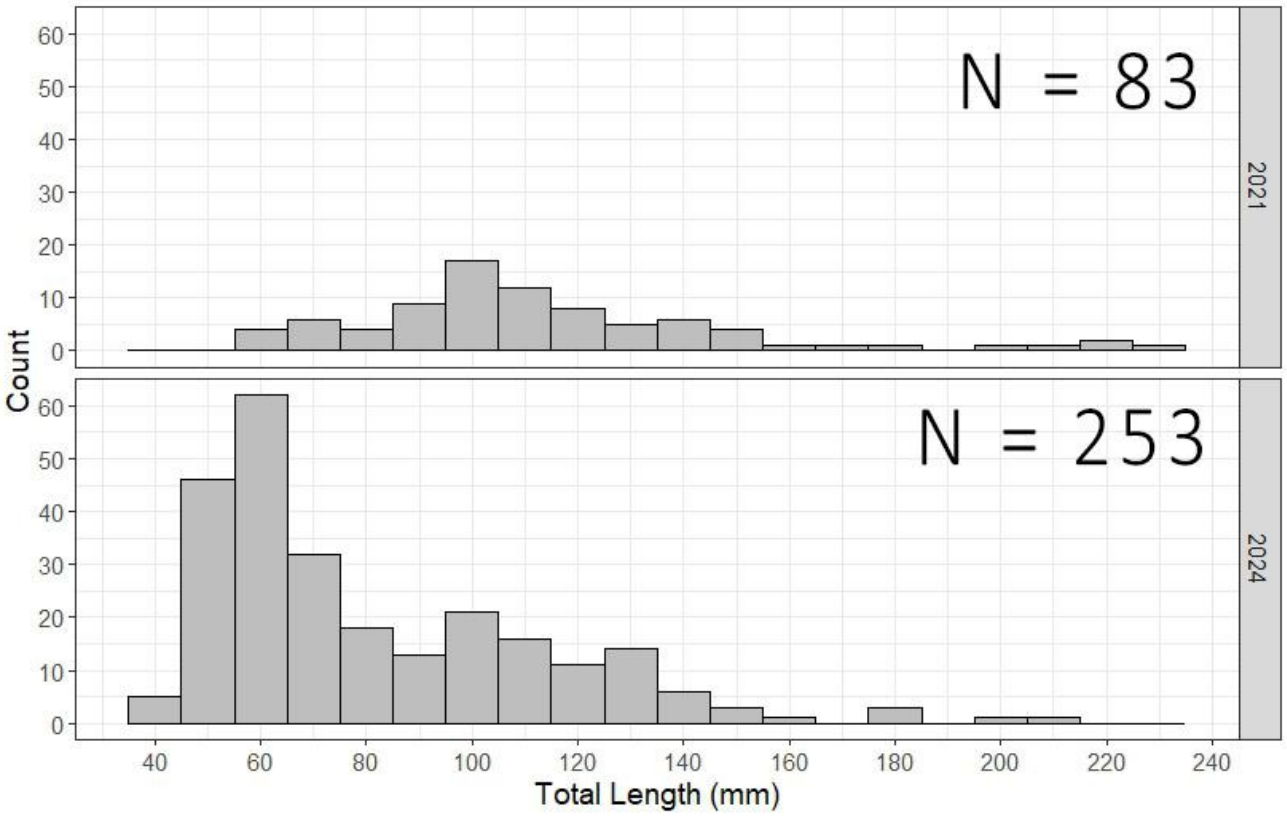

Figure 141. Length-frequency histogram of Gila Chub caught at Dix Creek, Greenlee Co., Arizona, 2021 and 2024. Total number of Gila Chub caught is denoted in top right of figure.

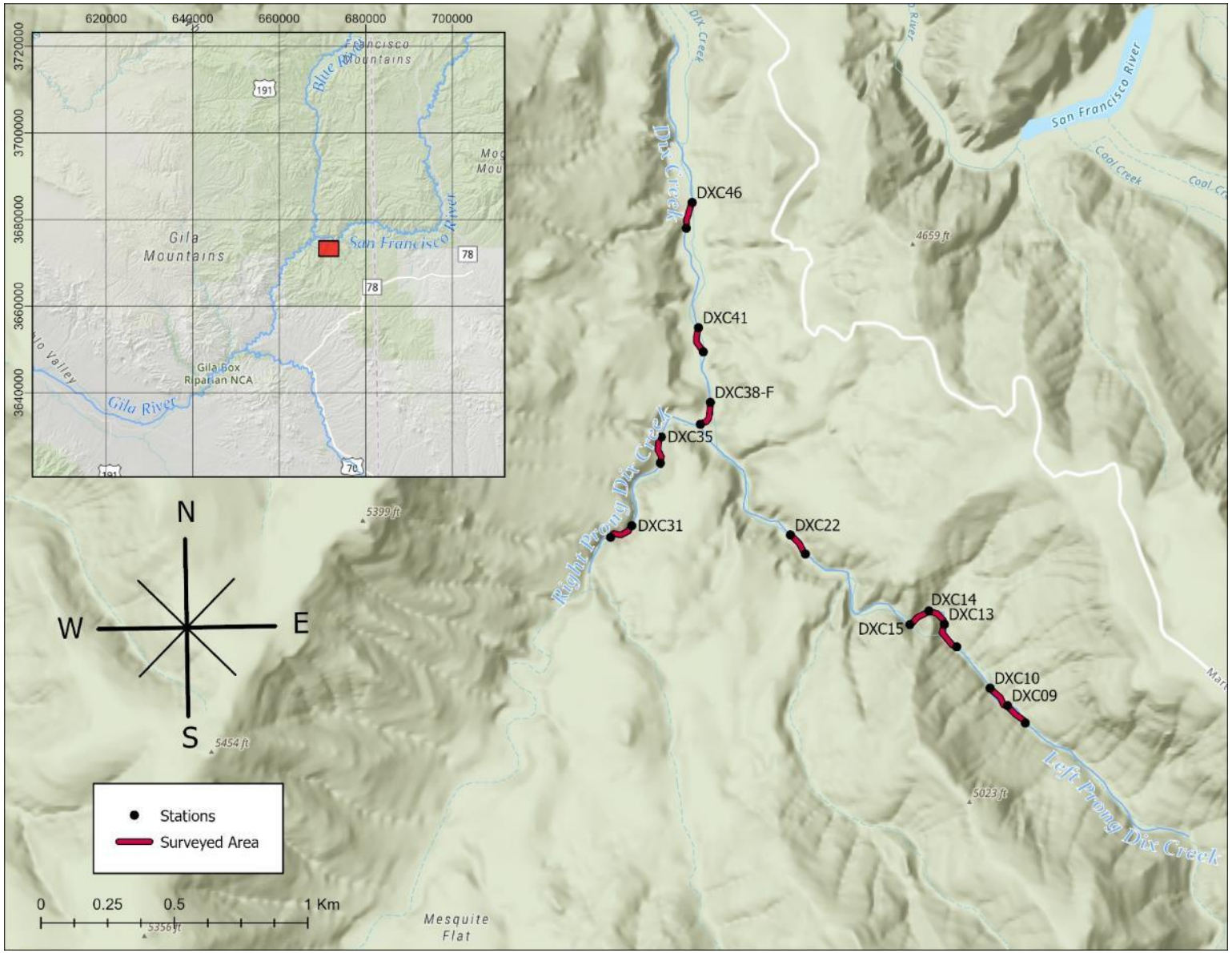

Figure 142. Location of stations surveyed at Dix Creek, Greenlee Co., Arizona, surveyed September 9-11, 2024.

Figure 143. Downstream to downstream view of DXC38-F, Dix Creek, Arizona.

Figure 144. Downstream to upstream view of DXC38-F, Dix Creek, Arizona.

Figure 145. Upstream to downstream view of DXC38-F, Dix Creek, Arizona.

Figure 146. Upstream to upstream view of DXC38-F, Dix Creek, Arizona.

Lower Blue River October 7 – 9, 2024

Station		Lower Boundary	Upper Boundary
LBL08	12S NAD83	667477E, 3677466N	667490E, 3677667N
LBL15-F		668151E, 3678440N	668165E, 3678272N
LBL20		668575E, 3678470N	668441E, 3678595N
LBL27		668525E, 3679464N	668655E, 3679592N
LBL38		668341E, 3680918N	668263E, 3681085N
LBL44		667741E, 3681735N	667708E, 3681939N
LBL49		668107E, 3682574N	668150E, 3682784N
LBL56		668111E, 3683943N	668037E, 3684068N
LBL58		667835E, 3684054N	667831E, 3684181N
LBL64-F		667956E, 3685036N	668089E, 3685219N
LBL69		668172E, 3685881N	668188E, 3686049N
LBL73		668404E, 3686367N	668181E, 3686395N
LBL77		668388E, 3686822N	668413E, 3686954N
LBL85		668390E, 3687673N	668391E, 3687848N
LBL90-F		668621E, 3688486N	668644E, 3688593N

Blue River (Greenlee Co., AZ) is a major tributary to San Francisco River and is in Apache Sitgreaves NF. Following the 2011 Wallow Fire, Spikedace, Loach Minnow, and Roundtail Chub were stocked into lower Blue River and all were considered established as self-sustaining populations (Robinson et al. 2017). A fish barrier located 0.8 km upstream from San Francisco River confluence was constructed in 2012 to prevent movement of non-native fishes upstream. Non-natives including Channel Catfish *Ictalurus punctatus*, Red Shiner *Cyprinella lutrensis*, Green Sunfish, and Fathead Minnow *Pimephales promelas* have not been captured or observedupstream of the barrier during surveys in 2013, 2015, 2016, and 2017 (Hickerson et al. 2021). Lower Blue River monitoring efforts have been conducted annually since 2012. Spikedace and Loach Minnow were the focal species for this site. The survey of lower Blue River conducted in 2023 captured 188 Spikedace, but no Loach Minnow (Reap et al. 2024).

M&A personnel surveyed the lower Blue River October 7-9, 2024. Sampling was completed by single-pass backpack electrofishing. Stations LBL83, LBL86 and LBL90-F (Reach 6) were accessed from hiking XXX Ranch Road and the remaining 12 stations were accessed by hiking from the Juan Miller Road crossing (Figure 147).

Fifteen, 200-meter stations (12 random, 3 fixed) in reaches one through six (Barrier to Fritz Ranch) were surveyed. Data from stations LBL62 and LBL68 were lost due to malfunction with one data collecting device, the catch totals reported here will be only from the other 13 surveyed stations.

Totals of 182 Spikedace, one Loach Minnow, 2,235 Desert Sucker, 573 Sonora Sucker, 532 Speckled Dace, 476 Longfin Dace, and 303 Roundtail Chub were captured across all reaches (Table 25). Loach Minnow was captured for the first time since 2020 when 645 individuals were captured and was found

150-m upstream of Juan Miller Road. Lowland Leopard Frogs and Northern Crayfish were observed throughout the stations surveyed.

Overall catch decreased slightly from last year's overall catch of 5,347, but this could be due to the data loss as previously mentioned. Most Spikedace captured were adult (>40 mm; 83.5%) and were captured in 11 of 13 stations surveyed. The stations with the most Spikedace captured (n=52) came from the fixed station (LBL64-F) at Juan Miller Road crossing and LBL55 (1.8 km downstream) where stocking efforts by AZGFD occurred in 2023.

Substrate in the lower Blue has reduced embeddedness since the last two surveys, with the most improved conditions occurring this year, which may account for the first Loach Minnow capture in four years. The stations downstream of LBL15-F to the fish barrier were dry. In last year's survey the river was dry below station LBL18.

CPUE trends for focal species at Lower Blue River across a 10-year period are included below (Figure 148) as well as length-frequency histograms of Spikedace captured from the last five surveys (Figure 149). Subsequent monitoring efforts will inform how successful the most recent stockings have been and how the two cohorts responded to being stocked into the lower Blue River. Data from 2012- 2019 were collected by AZGFD and provided by Reclamation. Spikedace CPUE increased from 2023, but similar catch and decreased effort could explain the change.

Average stream discharge across the three fixed stations was calculated to be 0.03 m3 /s (1.01 cfs). Average water temperature, DO, pH, and conductivity across the three fixed stations was 19.7 °C, 7.94 mg/L, 8.57, and 700 µS, respectively. Photographs of upper and lower extents of each fixed station are provided below (Figures 150-162).

Loach Minnow being present at Juan Miller Road Crossing was most likely due to improvements in substrate over the course of the last several years postfire. Substrate in the lower Blue River in the last three surveys was described as extremely embedded cobble in riffles and runs, and silt in pools. In 2024, loose cobble and pebble substrate was encountered throughout all reaches. This change in the substrate potentially provides habitat more conducive to Loach Minnow than previously available and fish have migrated downstream from small populations that survived impacts of the Cow Canyon fire in 2020. This is a unique opportunity to witness and study how Loach Minnow recover from devastating disturbances if no intervention takes place in the coming years.

Table 25. Catch summary table of fish captured at lower Blue River, Greenlee Co., Arizona, by backpack electrofishing, surveyed on October 7-9, 2024. Total effort was 11,932 seconds.

Reach	Stations	Statistic	AGCH	CAIN	GIRO	MEFU	PACL	RHOS	TICO	Totals
1 (1,148 sec)	LBL09 LBL11 LBL15-F	Count	18	17	12	4	42	0	0	93
		% total catch	19.35%	18.28%	12.90%	4.30%	45.16%	0.00%	0.00%	100.00%
		CPUE (ind/hr)	268.88	253.94	179.25	59.75	627.39	0.00	0.00	1389.21
2 (1,869 sec)	LBL25 LBL34	Count	107	128	100	10	383	37	0	765
		% total catch	13.99%	16.73%	13.07%	1.31%	50.07%	4.84%	0.00%	100.00%
		CPUE (ind/hr)	211.42	252.91	197.59	19.76	756.75	73.11	0.00	1511.53
3 (1,869 sec)	LBL41 LBL50	Count	85	98	65	34	263	68	0	613
		% total catch	13.87%	15.99%	10.60%	5.55%	42.90%	11.09%	0.00%	100.00%
		CPUE (ind/hr)	155.88	179.72	119.21	62.35	482.32	124.71	0.00	1124.20
4 (1,869 sec)	LBL55	Count	26	144	58	52	343	61	0	684
		% total catch	3.80%	21.05%	8.48%	7.60%	50.15%	8.92%	0.00%	100.00%
		CPUE (ind/hr)	64.02	354.58	142.82	128.04	844.60	150.21	0.00	1684.27
5 (1,869 sec)	LBL64-F LBL71	Count	35	138	58	75	334	67	1	708
		% total catch	4.94%	19.49%	8.19%	10.59%	47.18%	9.46%	0.14%	100.00%
		CPUE (ind/hr)	43.61	171.96	72.27	93.46	416.20	83.49	1.25	882.24
6 (1,931 sec)	LBL83 LBL86 LBL90-F	Count	205	48	10	7	870	299	0	1439
		% total catch	14.25%	3.34%	0.69%	0.49%	60.46%	20.78%	0.00%	100.00%
		CPUE (ind/hr)	207.59	48.61	10.13	7.09	881.01	302.78	0.00	1457.22
Total		Count	476	573	303	182	2235	532	1	4302
		% total catch	11.06%	13.32%	7.04%	4.23%	51.95%	12.37%	0.02%	100.00%
		CPUE (ind/hr)	143.61	172.88	91.42	54.91	674.32	160.51	0.30	1297.96

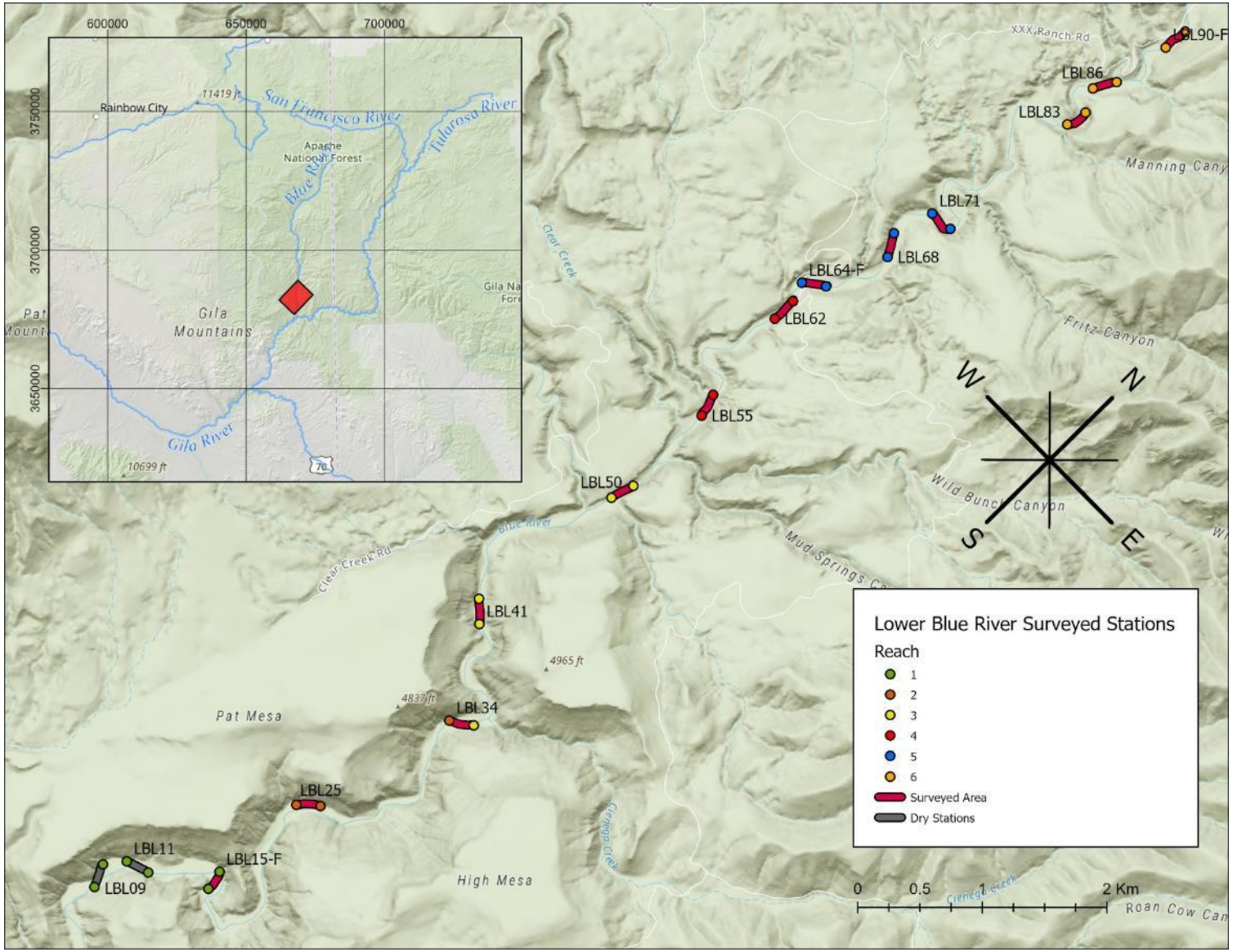

Figure 147. Location of sampling stations at lower Blue River, Greenlee Co., Arizona, surveyed on October 7-9, 2024.

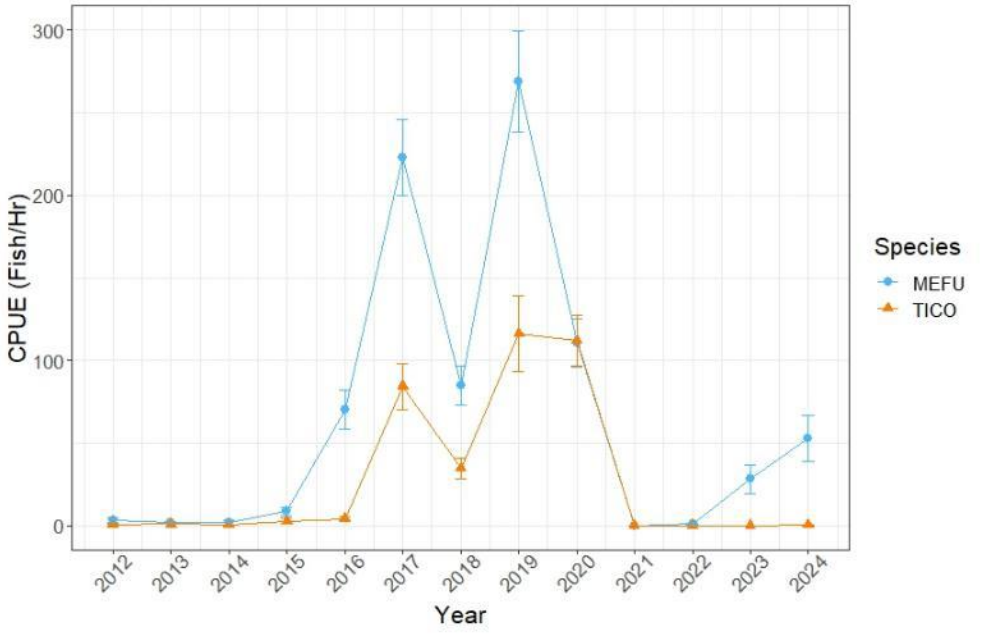

Figure 148. Mean CPUE for all focal species from annual monitoring at lower Blue River, Greenlee Co., Arizona since 2012.

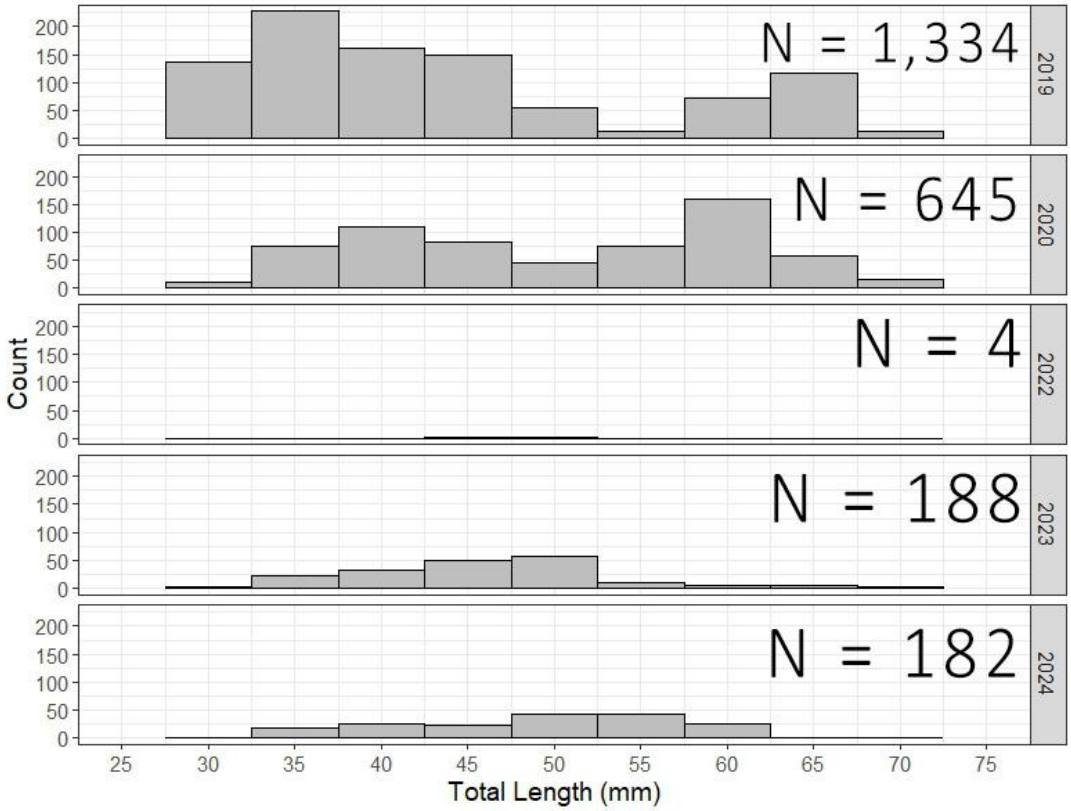

Figure 149. Length-frequency histogram of Spikedace captured at lower Blue River, Greenlee Co., Arizona, since 2019. No Spikedace were captured in 2021.

Figure 151. Downstream to downstream view of LBL15-F, lower Blue River, Arizona.

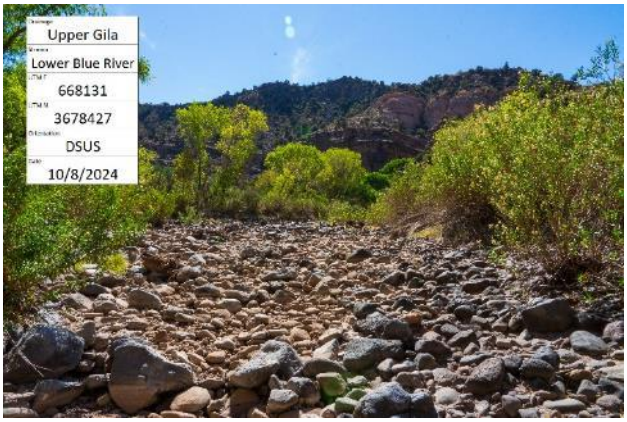

Figure 152. Downstream to upstream view of LL15-F, lower Blue river, Arizona.

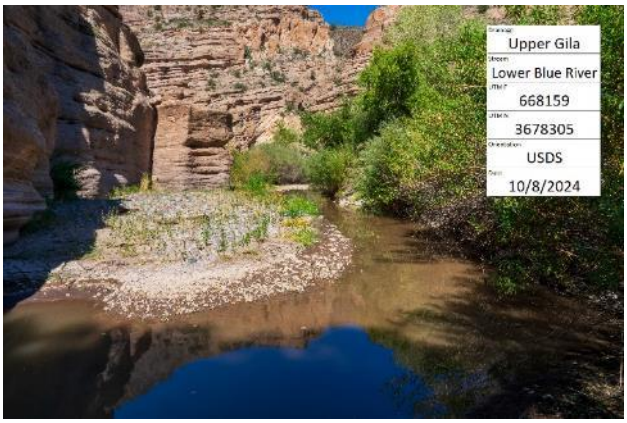

Figure 153. Upstream to downstream view of LBL15-F, lower Blue River, Arizona.

Figure 154. Upstream to upstream view of LBL15-F, lower Blue River, Arizona.

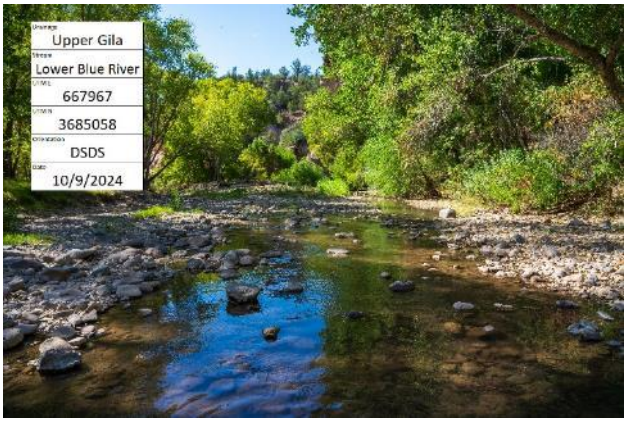

Figure 155. Downstream to downstream view of LBL64-F, lower Blue River, Arizona.

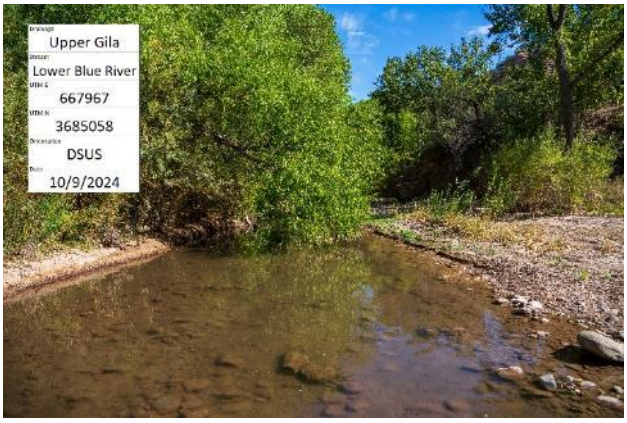

Figure 156. Downstream to upstream view of LBL64-F, lower Blue River, Arizona.

Figure 157. Upstream to downstream view of LBL64-F, lower Blue River, Arizona.

Figure 158. Upstream to upstream view of LBL64-F, lower Blue River, Arizona.

Figure 159. Downstream to downstream view of LBL90-F, lower Blue River, Arizona.

Figure 160. Downstream to upstream view of LBL90-F, lower Blue River, Arizona.

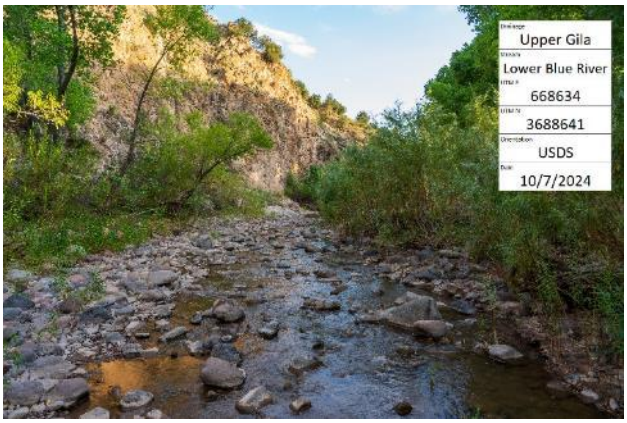

Figure 161. Upstream to downstream view of LBL90-F, lower Blue River, Arizona.

Figure 162. Upstream to upstream view of LBL90-F, lower Blue River, Arizona.

Lower Turkey Creek November 4-5, 2024

Station		Lower Boundary	Upper Boundary
TKC07-F	12S NAD83	734902E, 3665766N	734892E, 3665955N
TKC09		734898E, 3665358N	734900E, 3665565N
TKC13		734761E, 3664776N	734694E, 3664898N
TKC17		734554E, 3663925N	734654E, 3664072N

Turkey Creek (Grant Co., NM) is located northeast of Gila, NM in Gila National Forest. The lower Turkey Creek monitoring reach begins near Turkey Creek Hot Springs and flows 6 km to its confluence with the Gila River. Gila Chub was the focal species at this site. Turkey Creek was last surveyed for GRBMP in 2019 and 2021, resulting in capture of 197 and 17 Gila Chub, respectively (Shollenberger et al. 2022).

M&A personnel surveyed Turkey Creek on November 4-5, 2024. Sampling was completed via BPEF with dip nets. Lower Turkey Creek was accessed via Turkey Creek Trail at the end of Turkey Creek Road (Figure 163). Four, (1 fixed, 3 random) 200-m stations were completed with the most downstream station located 1,200-m upstream from the Gila River confluence and the most upstream station above Skeleton Canyon.

Across all surveyed stations, totals of 36 Gila Chub, 621 Desert Sucker, 369 Longfin Dace, 181 Sonora Sucker, 18 Speckled Dace, one Fathead Minnow, and one Flathead Catfish *Pylodictis olivaris* were captured. Gila Chub catch increased from 17 individuals caught in 2021 and overall catch in general increased from 70 in 2021 to 1,227 in 2024. Gila Chub were detected at every station. Catch and effort totals for all stations are summarized below (Table 26).

These numbers are dramatically higher compared to the previous survey 2021, but significantly lower than 2019 when 187 Gila Chub were captured across two 100-m stations. The Johnson Fire in May 2021, followed by an extraordinary monsoon season, had a negative impact on the fish assemblage in Turkey Creek. A large amount of burned woody debris was observed within the stream and large amounts of ashy sediment throughout our survey reach. Prior to the Johnson Fire, USFS personnel salvaged approximately 260 Gila Chub from Turkey Creek and reintroduced them into this reach shortly after monitoring efforts (D. Myers (USFS), personal communication, November 12, 2021). An initial effort to survey Turkey Creek in August 2021 was cancelled due to heavy rain and flood conditions. Gila Chub are recovering in Turkey Creek but are not yet at a relative abundance experienced prior to the fire.

Stream discharge was measured near the upstream boundary of TCK07-F and calculated to be 0.07 m^3/s (2.37 cfs). Water temperature, dissolved oxygen, pH, and conductivity at the fixed station were 17.7 °C, 6.3 mg/L, 8.52, and 322 µS, respectively. Photographs of upper and lower extents of the fixed station are provided below (Figures 164-167).

Table 26. Summary of catch of fish captured via BPEF at lower Turkey Creek, Grant Co., New Mexico, surveyed November 4-5, 2024. Total effort was 4,145 seconds.

Stations	Statistic	AGCH	CAIN	GIIN	PACL	PIPR	PYOL	RHOS	Totals
TKC07-F (557 sec)	Count	13	0	10	0	0	0	11	34
	% total catch	38.24%	0.00%	29.41%	0.00%	0.00%	0.00%	32.35%	100.00%
	CPUE (ind/hr)	84.021544	0	64.631957	0	0	0	71.095153	219.74865
TKC09 (1,025 sec)	Count	32	38	23	239	0	0	4	336
	% total catch	9.52%	11.31%	6.85%	71.13%	0.00%	0.00%	1.19%	100.00%
	CPUE (ind/hr)	112.39024	133.46341	80.780488	839.41463	0	0	14.04878	1180.0976
TKC13 (909 sec)	Count	149	22	1	98	0	0	3	273
	% total catch	54.58%	8.06%	0.37%	35.90%	0.00%	0.00%	1.10%	100.00%
	CPUE (ind/hr)	590.10	87.13	3.96	388.12	0.00	0.00	11.88	1081.19
TKC17 (1,654 sec)	Count	175	121	2	284	1	1	0	584
	% total catch	29.97%	20.72%	0.34%	48.63%	0.17%	0.17%	0.00%	100.00%
	CPUE (ind/hr)	380.89	263.36	4.35	618.14	2.18	2.18	0.00	1271.10
	Count	369	181	36	621	1	1	18	1,227
	% total catch	30.07%	14.75%	2.93%	50.61%	0.08%	0.08%	1.47%	100.00%
	CPUE (ind/hr)	320.48	157.20	31.27	539.35	0.87	0.87	15.63	1065.67

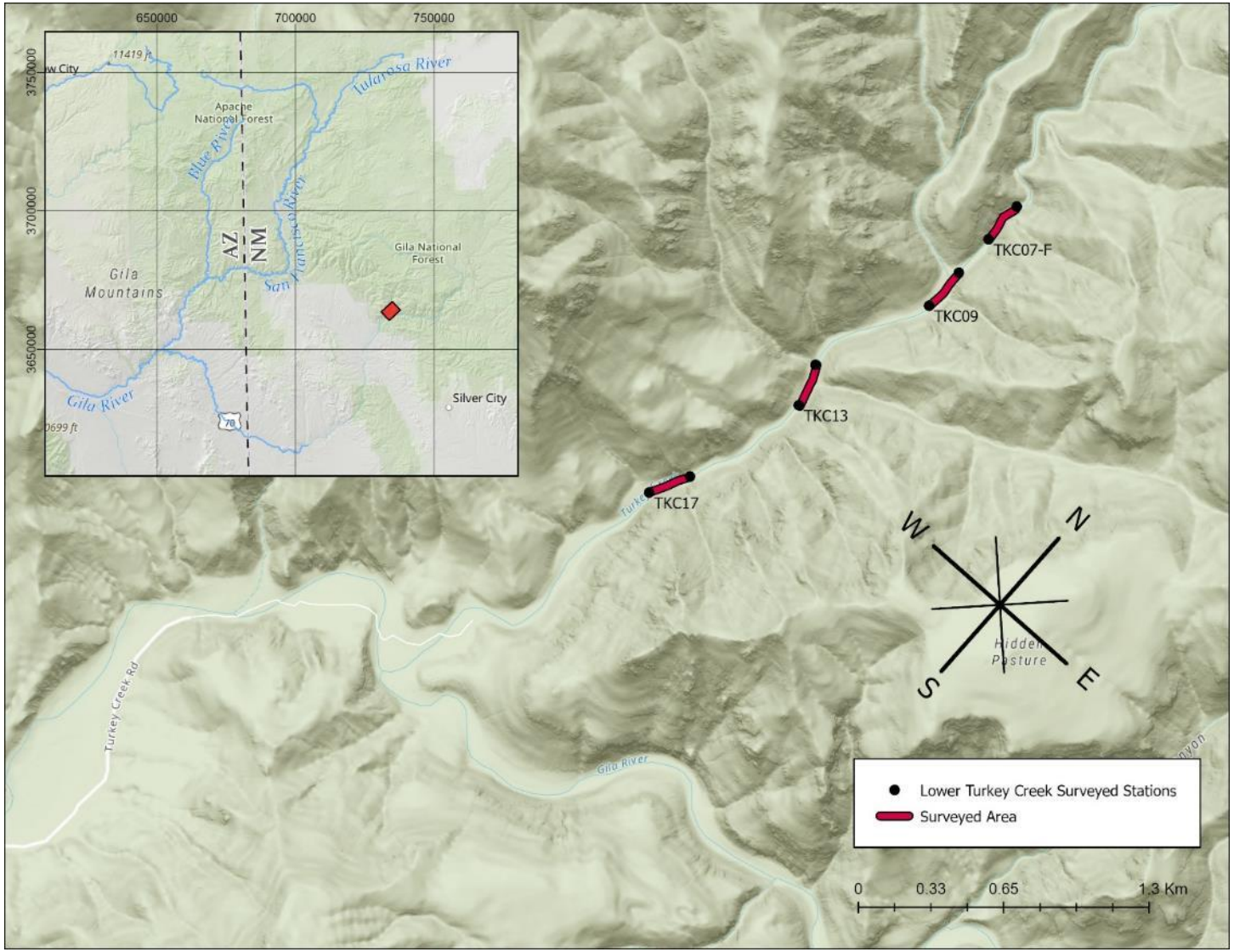

Figure 163. Location of sampled stations at lower Turkey Creek, Grant Co., New Mexico, surveyed November 4-5, 2024.

Figure 167. Upstream to upstream view of TKC07-F, lower Turkey Creek, New Mexico.

Figure 166. Upstream to downstream view of TKC07-F, lower Turkey Creek, New Mexico.

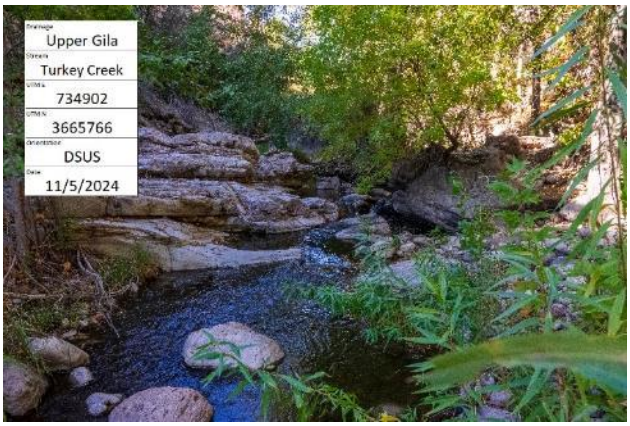

Figure 165. Downstream to upstream view of TKC07-F, lower Turkey Creek, New Mexico.

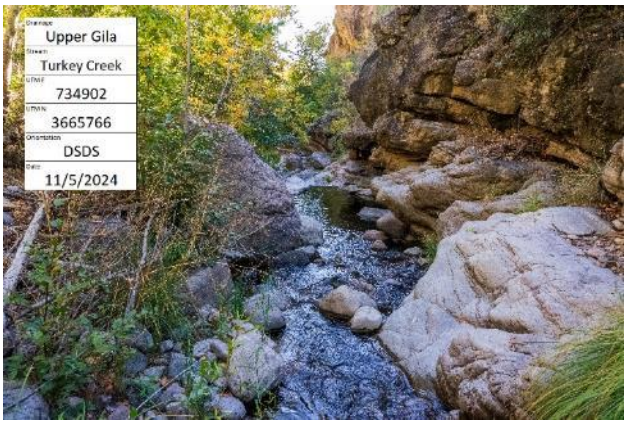

Figure 164. Downstream to downstream view of TKC07-F, lower Turkey Creek, New Mexico.

Bear Creek November 6, 2024

Station		Lower Boundary	Upper Boundary
BCK13	12S NAD83	734960E, 3650462N	734063E, 3650381N
BCK18		734257E, 3650720N	734342E, 3650589N
BCK22		733656E, 3650998N	733779E, 3650901N
BCK29-F		732586E, 3651116N	732752E, 3651133N

Bear Creek (Grant Co., NM) begins in Pinos Altos Mountain Range north of Silver City, NM in the Upper Gila sub-basin. The monitoring reach encompasses a 5.4 km section of stream that begins near Dorsey Spring. Loach Minnow was the focal species for this survey. Loach Minnow were first detected in Bear Creek in 2005 (Menzie and Hopkins 2009). Bear Creek was last surveyed for GRBMP in 2019 and 2021, resulting in the capture of 83 and 158 Loach Minnow, respectively (Shollenberger et al. 2022).

M&A, USFWS (Serena Kucera), and NMGFD (Jasmine Johnson) personnel completed sampling Bear Creek on November 6, 2024. Sampling was completed via BPEF. Bear Creek was accessed by parking at the Double E Ranch Management Area and hiking upstream to the survey stations. Coordination with NMGFD is required to access this property. Four 200-m stations were surveyed at Bear Creek with the lowest station beginning at the Double E Ranch Management Area property boundary and the upper-most station located 3.2 km upstream near Stone Canyon (Figure 168).

Across all four stations, totals of 253 Loach Minnow, 1,725 Longfin Dace, 698 Desert Sucker, and 362 Sonora Sucker were captured. More than half of the Loach Minnow captured (n=130) were captured at the fixed station (BCK29-F). NMGFD completed a supplemental stocking effort in 2023 that introduced ~100 individuals near the fixed station. Catch and effort totals for all surveyed stations are summarized in Table 27.

Loach Minnow were detected at all four stations with similar abundance throughout. The dominant mesohabitat was riffle with small cobble and pebble substrate. The high-quality Loach Minnow habitat and absence of predators are key factors in Loach Minnow success at Bear Creek.

Stream discharge was measured at the upstream boundary of BCK29-F and calculated to be 0.04 m^3/s (1.42 cfs). Water temperature, dissolved oxygen, pH, and conductivity at the fixed station were 14.9 °C, 6.2 mg/L, 8.10, and 448 µS, respectively. A length-frequency histogram for all Loach Minnow captured at Bear Creek is included below (Figure 169). Photographs of upper and lower extents of the fixed station are provided below (Figures 170-173).

Table 27. Summary catch table of fish captured via BPEF at Bear Creek, Grant Co., New Mexico, surveyed November 6, 2024. Total effort was 3,226 seconds.

Stations	Statistic	AGCH	CAIN	PACL	TICO	Totals
BCK13 (313 sec)	Count	133	66	107	23	329
	% total catch	40.43%	20.06%	32.52%	6.99%	100.00%
	CPUE (ind/hr)	1529.7125	759.10543	1230.6709	264.53674	3784.0256
BCK18 (1,045 sec)	Count	562	172	319	69	1122
	% total catch	50.09%	15.33%	28.43%	6.15%	100.00%
	CPUE (ind/hr)	1936.0766	592.53589	1098.9474	237.70335	3865.2632
BCK22 (895 sec)	Count	580	74	218	31	903
	% total catch	64.23%	8.19%	24.14%	3.43%	100.00%
	CPUE (ind/hr)	2332.96	297.65	876.87	124.69	3632.18
BCK29-F (973 sec)	Count	450	50	54	130	684
	% total catch	65.79%	7.31%	7.89%	19.01%	100.00%
	CPUE (ind/hr)	1664.95	184.99	199.79	480.99	2530.73
	Count	1725	362	698	253	3038
	% total catch	56.78%	11.92%	22.98%	8.33%	100.00%
	CPUE (ind/hr)	1924.98	403.97	778.92	282.33	3390.20

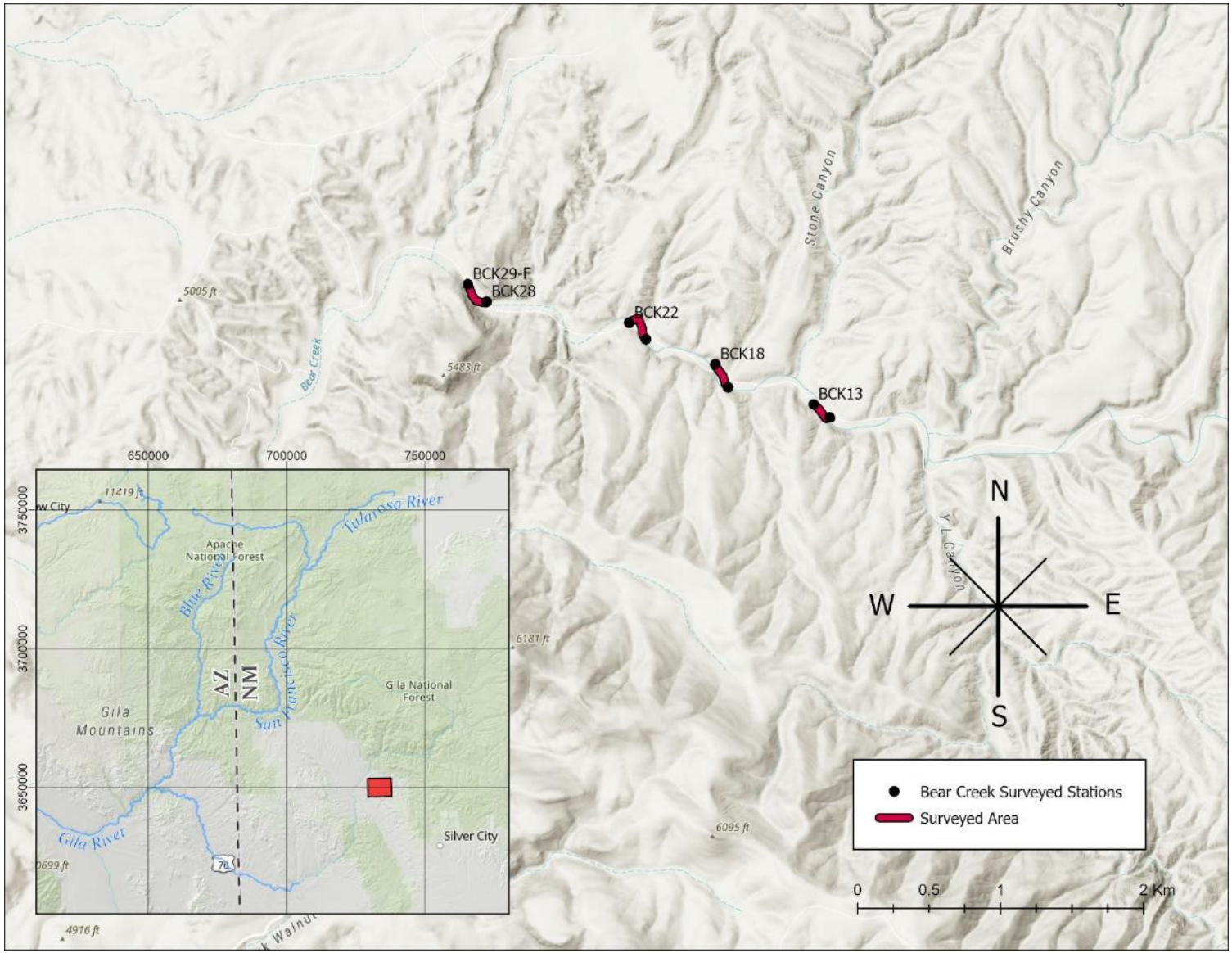

Figure 168. Location of sampled stations at Bear Creek, Grant Co., New Mexico, surveyed November 6, 2024

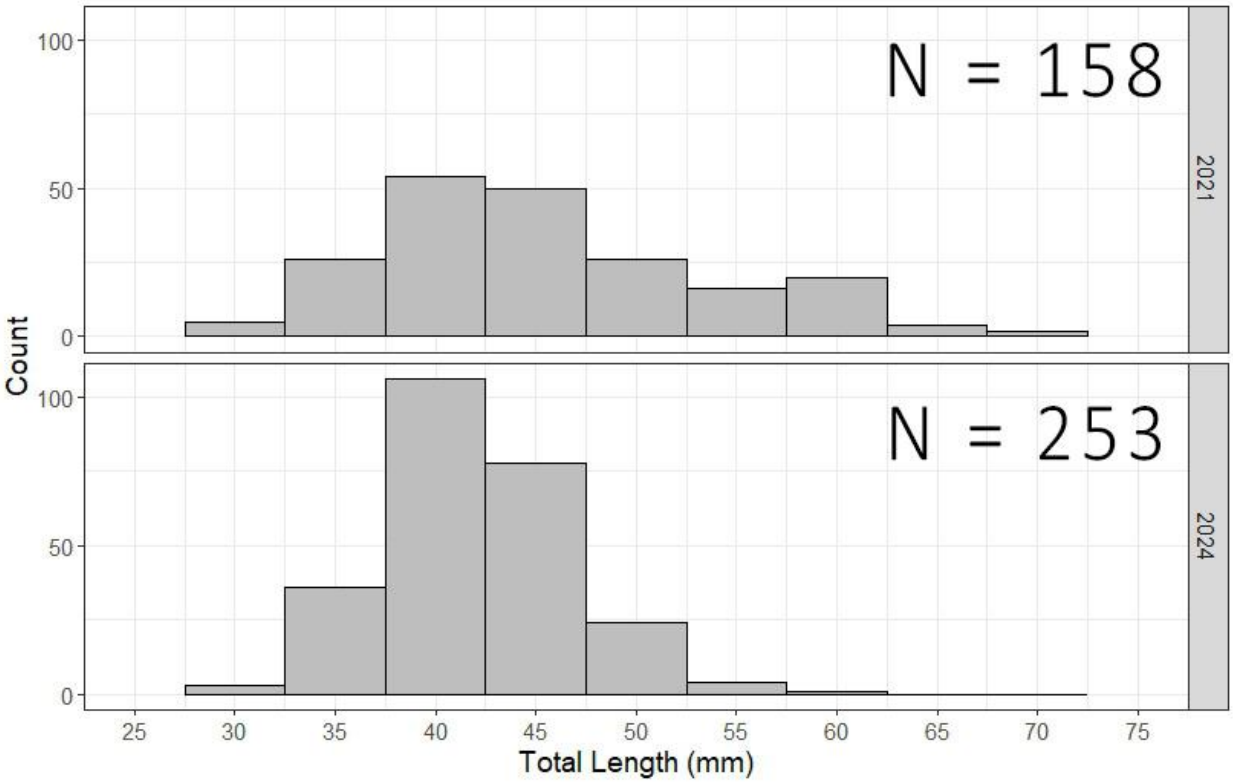

Figure 169. Length-frequency histogram of Loach Minnow captured at Bear Creek, Grant Co., New Mexico, 2021-2024. Total catch indicated in top right corners.

Figure 170. Upstream to upstream view of BCK29-F, Bear Creek, New Mexico.

Figure 171. Upstream to downstream view of BCK29-F, Bear Creek, New Mexico.

Figure 172. Downstream to upstream view of BCK29-F, Bear Creek, New Mexico.

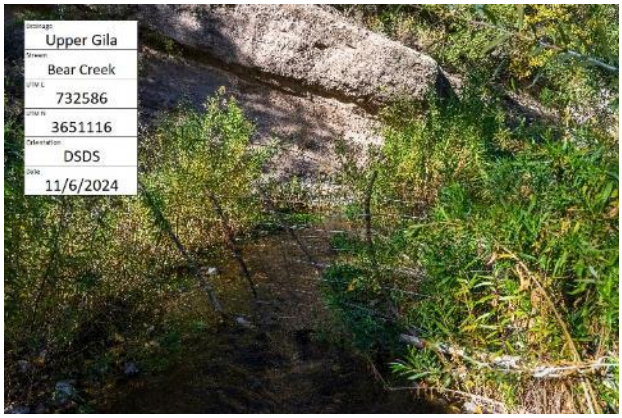

Figure 173. Downstream to downstream view of BCK29-F, Bear Creek, New Mexico.

Verde River Basin

Spring Creek September 24, 2024

Station		Lower Boundary	Upper Boundary
SPC01-F	12S NAD83	416150E, 3847274N	416166E, 3847347N
SPC12		416505E, 3845829N	416562E, 3845802N
SPC14-F		416628E, 3845822N	416562E, 3845914N

Spring Creek (Yavapai Co., AZ) is in Verde River drainage and is tributary to Oak Creek near Cornville, AZ (Figure 143). Gila Topminnow, Gila Chub, and Spikedace were the focal species at Spring Creek. For 2023, only Gila Topminnow was targeted because AZGFD currently is conducting post-stocking monitoring for Spikedace via BPEF. A fish barrier was constructed in 2015 to prevent the invasion of non-native fishes including Green Sunfish from Oak Creek. Gila Topminnow (Lower Santa Cruz - Peck Canyon lineage) were stocked into Spring Creek in 2015 and 2016 and a small population appeared to establish in the pool above the fish barrier (Robinson et al. 2017). Spring Creek was last monitored for this program in 2023 and captured 166 Gila Topminnow.

M&A personnel completed sampling of Spring Creek on September 24, 2024. Three (2 fixed, 1 random), 100-m stations were surveyed (Figure 174). Ten minnow traps were set in each station resulting in a total of 116.1 trap hours. The upper reach of Spring Creek containing station SPC01-F was accessed via East Willow Pt Road. The downstream stations were accessed by North Oak Creek Valley Road to a trail just north of a gated community. A summary of catch of all fish in this survey is provided below (Table 28).

Totals of 661 Gila Topminnow, 424 Gila Chub, 104 Longfin Dace, 143 Speckled Dace, and 78 Northern Crayfish were captured. Most of the Gila Topminnow (n=644) were captured in slow-moving water immediately upstream (~ 20 m) of the fish barrier within the lowest fixed station (SPC14-F). When surveyed in 2023, 166 Gila Topminnow were captured at this site. Gila Chub catch total was higher than in 2023, when 325 individuals were captured.

Mesohabitat upstream of the fish barrier was a slow-moving shallow run dominated by clay/silt substrate. Once mesohabitat transitioned to step-runs, cobble and gravel were the dominant substrates. Average discharge across both fixed stations was measured at 0.083 m^3/s (2.95 cfs). Average water temperature, DO, pH, and conductivity was 20.4 °C, 24.1 mg/L, 8.21, and 552 µS, respectively. Photographs of upper and lower extents of fixed stations are provided below (Figures 175-182).

Table 28. Summary of catch via minnow trap at Spring Creek, Yavapai Co., Arizona, surveyed September 24, 2024. Total effort was 116.1 trap hours.

Stations	Statistic	AGCH	GIIN (<=50)	GIIN (51-100)	GIIN (>100)	POOC (<20)	POOC (>20)	RHOS	FAVI	Totals
SPC01-F (34.0 hrs)	Count	103	2	83	5	0	0	123	11	327
	% total catch	31.50%	0.61%	25.38%	1.53%	0.00%	0.00%	37.61%	3.36%	100.00%
	CPUE (ind/hr)	3.03	0.06	2.44	0.15	0.00	0.00	3.62	0.32	9.61
SPC12 (42.5 hrs)	Count	0	1	22	0	0	17	18	36	94
	% total catch	0.00%	1.06%	23.40%	0.00%	0.00%	18.09%	19.15%	38.30%	100.00%
	CPUE (ind/hr)	0.00	0.02	0.52	0.00	0.00	0.40	0.42	0.85	2.21
SPC14-F (39.5 hrs)	Count	1	12	293	6	87	557	2	31	989
	% total catch	0.10%	1.21%	29.63%	0.61%	8.80%	56.32%	0.20%	3.13%	100.00%
	CPUE (ind/hr)	0.03	0.30	7.41	0.15	2.20	14.09	0.05	0.78	25.02
	Count	104	15	398	11	87	574	143	78	1,410
	% total catch	7.38%	1.06%	28.23%	0.78%	6.17%	40.71%	10.14%	5.53%	100.00%
	CPUE (ind/hr)	0.90	0.13	3.43	0.09	0.75	4.94	1.23	0.67	12.15

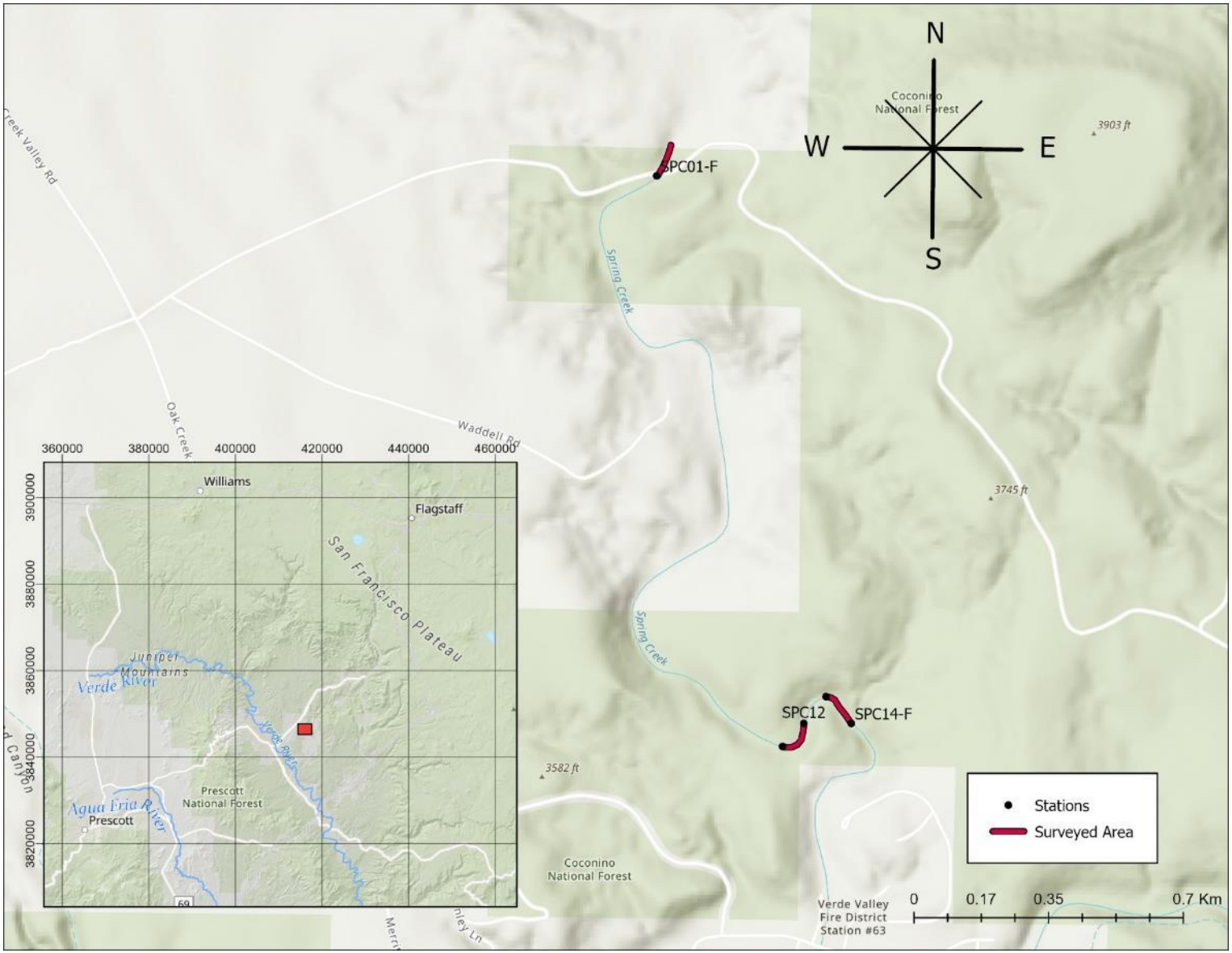

Figure 174. Location of stations sampled at Spring Creek, Yavapai Co., Arizona, surveyed September 24, 2024.

Figure 175. Upstream to upstream view of SPC01-F, Spring Creek, Arizona.

Figure 176. Upstream to downstream view of SPC01-F, Spring Creek, Arizona.

Figure 177. Downstream to downstream view of SPC01-F, Spring Creek, Arizona.

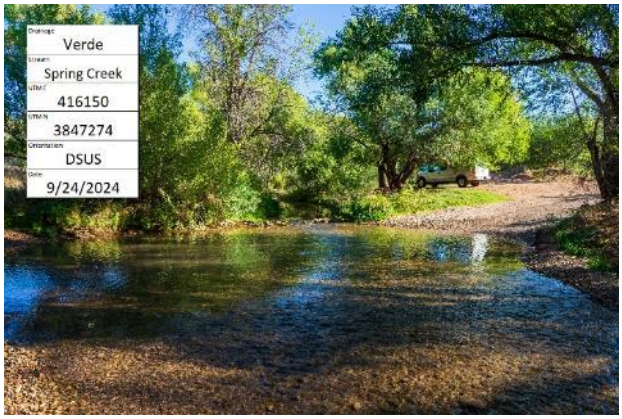

Figure 178. Downstream to upstream view of SPC01-F, Spring Creek, Arizona.

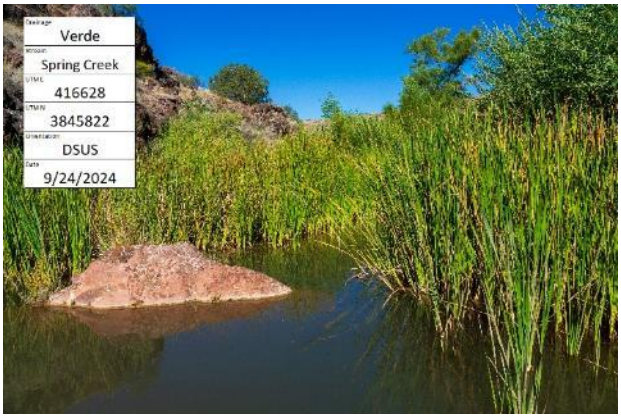

Figure 179. Downstream to upstream view of SPC14-F, Spring Creek, Arizona.

Figure 180. Downstream to downstream view of SPC14-F, Spring Creek, Arizona.

Figure 183. Upstream to upstream view of SPC14-F, Spring Creek, Arizona.

Figure 184. Upstream to downstream view of SPC14-F, Spring Creek, Arizona.

Acknowledgements

The following individuals are acknowledged for their assistance in varying capacities: Kurt Shollenberger, Wes Franklin, Alex Marini, Garrett Percy, Cora McClelland, and Allison Downey (M&A); Kent Mosher and Betsy Heddon (Reclamation); Ron Day, Joe Koch, Marty Lawrence, Peter Leiterman, and Jessie Pearl (TNC); Ian Murray, Mead Mier, Amanda Webb, John Walker, and Sami Hammer (Pima County); Stephanie Coleman, Kelly Kessler, Mathew Lane, Yvette Paroz (Forest Service); Nate Berg, Brian Hickerson, Alex Cameron, Chrissy Kondrat-Smith, Jim Ruff, John Windes (AZGFD); Jasmine Johnson (NMDGF); Colt Alford, Dawn Collins, and Athena Sparks (Arizona State Parks); and Doug Duncan (FWS Retired). Collections were authorized under permits issued by FWS and the states of Arizona and New Mexico. Care and use of fish in this study was approved by the Institutional Animal Care and Use Committee, protocol numbers 18-1640R and 21-1827R. Cover photo of Harden Cienega Creek, Greenlee Co., Arizona, by Paul Reap.

Literature Cited

Arizona Game and Fish Department (AZGFD). 2018. Petition to reclassify Gila Topminnow, *Poeciliopsis occidentalis*, from endangered to threatened. Submitted to U.S. Fish Wildlife Service, Arizona Ecological Services Office, Phoenix, Arizona: Arizona Game and Fish Department.

Burgad A.A., J.J. Rennert, L.J. McCall, B.R. Kesner, and P.C. Marsh. 2019. Gila River Basin Native Fish Monitoring, 2018 Final Annual Report. in partial fulfilment of: Bureau of Reclamation Contract No. R17PC00108. Marsh & Associates, Tempe, AZ. 77 pages + appendices

Gray, T. 2018. Petition to reclassify Gila Topminnow, Poeciliopsis occidentalis, from endangered to threatened status. Arizona Game and Fish Department, Phoenix, AZ. 110 pages.

Hickerson, B.T. and A.T. Robinson. 2019. Gila River Basin Native Fishes Conservation Program: Arizona Game and Fish Department's native fish conservation efforts during 2018. An Arizona Game and Fish Department Annual Report for Cooperative Agreement No. R16AC00077 submitted to U.S. Bureau of Reclamation, Phoenix Area Office. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix.

Hickerson, B.T., E.R. Grube, K.R. Mosher, and A.T. Robinson. 2021. Successful Restoration of a Native Fish Assemblage in the Blue River, Arizona. North American Journal of Fisheries Management, 41: 746-756. https://doi.org/10.1002/nafm.10584

Hickerson, B.T., J. Walters, and A.T. Robinson. 2021. Gila River Basin Native Fishes Conservation Program: Arizona Game and Fish Department's native fish conservation efforts during 2020. An Arizona Game and Fish Department Annual Report for Cooperative Agreement No. R16AC00077 submitted to U.S. Bureau of Reclamation, Phoenix Area Office. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix.

Jones, A.C., K. R. Mosher, C. Crowder. 2016. Description of a previously unknown population of an endangered desert fish, *Poeciliopsis occidentalis occidentalis*. The Southwestern Naturalist, 61(4), 329-331

Johnson, C. J., M. P. Zeigler, J. M. Wick. 2022. Gila River Basin Native Fishes Conservation Program: New Mexico Department of Game and Fish 2021 Annual Report. Cooperative Agreement (R21AC10115) submitted to Bureau of Reclamation, Phoenix Area Office. New Mexico Department of Game and Fish Fisheries Management Division.

Lazorchak, J.M., D.J. Klemm, and D.V. Peck, editors. 1998. Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Wadeable Streams. EPA/620/R94/004F. Washington, D.C.: U.S. Environmental Protection Agency.

Mitchell, D. 2007. Fresno Canyon Renovation 2007. Arizona Game and Fish Department. 6 pages.

Mosher, K.R., W.T. Stewart, and S.J. Kline. 2020. Long-Term Monitoring Plan for Native Fish Populations in the Gila River Basin. Revision 1.0. Phoenix, Arizona: U.S. Bureau of Reclamation.

QGIS Development Team. 2023. QGIS Geographic Information System. Open Source Geospatial Foundation Project. http://qgis.osgeo.org.

Robinson, A.T. 2016. Gila River Basin Native Fishes Conservation Program: Arizona Game and Fish Department annual report for June 30, 2015, through June 30, 2016. A Gi. River Basin Native Fishes Conservation Program Annual Performance Report for U.S. FU.S. d Wildlife Service Cooperative Agreement No. F14AC00148. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix.

Robinson, A. T., K. Mosher, and K. Smith. 2017. Gila River Basin Native Fishes Conservation Program: Arizona Game and Fish Department's native fish conservation efforts during 2016 and 2017 work plan. An Arizona Game and Fish Department Annual Report for Cooperative Agreement No. R16AC00077 submitted to U.S. Bureau of Reclamation, Phoenix Area Office. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix.

Shollenberger, K.R., A.A. Burgad, J.J. Rennert, B.R. Kesner, and P.C. Marsh. 2020. Gila River Basin Native Fish Monitoring 2019 Annual Report. Report, U.S. Bureau of Reclamation, Phoenix, Arizona, Agreement No. R17PC00108. Marsh & Associates, Tempe, Arizona. 85 pages + appendices.

Shollenberger, K.R., B.R. Kesner, and P.C. Marsh. 2021. Gila River Basin Native Fish Monitoring 2020 Annual Report. Report, U.S. Bureau of Reclamation, Phoenix, Arizona, Agreement No. R17PC00108. Marsh & Associates, Tempe, AZ. 64 pages + appendices.

Shollenberger, K.R., B.R. Kesner, and P.C. Marsh. 2022. Gila River Basin Native Fish Monitoring 2021 Final Annual Report. Report, U.S. Bureau of Reclamation, Phoenix, Arizona, Agreement No. R17PC00108. Marsh & Associates, Tempe, AZ. 110 pages + appendices.

Timmons, R.J., and S.A. Paulus. 2016. Fish monitoring in selected streams within the Gila River Basin, 2015. Annual report in partial fulfillment of: Bureau of Reclamation Contract No. R12PC32007. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix, Arizona. 40 pages + appendices.

Timmons, Ross J., S.A. Paulus, and L.J. Upton. 2015. Fish monitoring of selected streams within the Gila River Basin, 2014 Annual Report. Annual Rep. to Bureau of Reclamation, Contract No. R12PC32007. Arizona Game and Fish Department, Nongame Branch, Phoenix, Arizona. 51 pages + appendices.

U.S. Fish and Wildlife Service. 1994. Endangered Species Act Section 7 Biological Opinion on transportation and delivery of Central Arizona Project water to the Gila River Basin (Hassayampa, Agua Fria, Salt, Verde, San Pedro, Middle and Upper Gila River and associated tributaries) in Arizona and New Mexico. 2-21-90-F-119, April 15, 1994.

U.S. Fish and Wildlife Service. 2001. Background information on the Central Arizona Project and nonnative aquatic species in the Gila River basin (excluding the Santa Cruz River sub-basin). U.S. Fish and Wildlife Service, Phoenix, Arizona.

U.S. Fish and Wildlife Service. 2021. Biological and Conference Opinion for Wildlife and Sport Fish Restoration Funding of the Arizona Game and Fish Department's Statewide Sport Fish Stocking Program for 2021 – 2031. U.S. Fish and Wildlife Service, Arizona Ecological Services Office, Phoenix, Arizona. 1095 pages.

Weedman, D.A. 1999. Gila Topminnow, *Poeciliopsis occidentalis*, revised draft recovery plan. Ariz. Game and Fish Department, Phoenix, Arizona.

Weedman, D.A., A.L. Girmendonk and K.L. Young. 1996. Status review of Gila Chub, *Gila intermedia*, in the United States and Mexico. Nongame and Endangered Wildlife Program Technical Report #91, Arizona Game and Fish Department, Phoenix, Arizona.