Nonnative Fish Removal from Aravaipa and Bonita Creeks 2024 Annual Report

Interagency Agreement (R22PG00016) Between Bureau of Reclamation
And
Bureau of Land Management, Safford Field Office

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March 14, 2025

Project Title: Nonnative fish removal from Bonita and Aravaipa Creeks (Task ID: AZ-2009-1).

Strategic Plan Goals for Bonita and Aravaipa Creeks:

Preventing Extinction and Managing Toward Recovery

Goal 4. Remove nonnative aquatic species threats.

Goal 9. Monitor to quantitatively measure and evaluate project success in improving the status of target species and their habitats.

BONITA CREEK ANNUAL REPORT

Recovery Goals/Objectives for Bonita Creek Fish:

Nonnative fish removal from Bonita Creek will help secure populations of Gila Chub (*Gila intermedia*) and Gila Topminnow (P*oeciliopsis o. occidentalis*) and address the following recovery goals identified for each species in their respective recovery plans.

Recovery Objectives for Gila Chub:

Gila Chub draft recovery plan (2015)

Task 1. Protect and manage remnant populations and their habitats.

Gila Chub draft 2015 recovery plan objective 1.3.1 - Eliminate or control problematic nonnative aquatic organisms.

Task 7. Use adaptive management practices to guide future recovery actions where uncertainty exists.

Gila Chub draft 2015 recovery plan objective 7 - Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.

Recovery Objectives for Gila Topminnow:

Gila Topminnow draft recovery plan (1999)

Task 1. Prevent extinction by protecting remaining natural and long-lived reestablished populations.

Gila Topminnow 1999 draft revised recovery plan objective 1.5 - Protect remaining natural and long-lived reestablished populations from invasion by detrimental nonnative aquatic species.

Task 2. Reestablish and protect populations throughout historic range.

Gila Topminnow 1999 draft revised recovery plan objective 2.4 - Protect habitats of reestablished or potential populations from detrimental nonnative aquatic species.

Task 3. Monitor natural and reestablished populations and their habitats.
Gila Topminnow 1999 draft revised recovery plan objective 3 - Monitor natural and reestablished populations and their habitats.

Geographical Area: Bonita Creek originates in the Gila Mountains on the San Carlos Apache Indian Reservation. It flows southeasterly from its headwaters approximately 46 miles to its confluence with the Gila River. The Bonita Creek watershed drains approximately 370 square miles and consists of federal, city, tribal, and private lands. From the reservation boundary downstream, BLM's SFO manages approximately 92% of the lands and the remaining 8% are City of Safford and private holdings. The two managers/landowners, the Bureau of Land Management (BLM), Safford Field Office (SFO), and City of Safford support the project.

Background for Bonita Creek: In 2008, the Bureau of Reclamation (BOR), through the Gila River Basin Native Fishes Conservation Program, constructed a fish barrier across lower Bonita Creek. This barrier was designed to prevent the upstream incursion of nonnative aquatic species from the Gila River into both lower and upper segments of Bonita Creek, as part of a multi-agency native fish restoration project. The purpose was to protect the existing fish fauna, including endangered Gila Chub, Longfin Dace (*Agosia chrysogaster*), Speckled Dace (*Rhinichthys osculus*), Sonora Sucker (*Catostomus insignis*), and Desert Sucker (*Pantosteus clarkii*), and to secure habitat for the repatriation of other imperiled Gila basin fish (Figure 1).

Additionally, the reach of Bonita Creek between the City of Safford infiltration gallery dike and the fish exclusion barrier was chemically renovated with the piscicide rotenone to eliminate nonnative fishes. Shortly after the chemical treatment, nonnative fishes, including Western Mosquitofish (*Gambusia affinis*) and Green Sunfish (*Lepomis cyanellus*) in 2009, Fathead Minnow (*Pimephales promelas*) in 2010, and Yellow Bullhead (*Ameiurus natalis*) in 2011, were discovered in the renovated portion of Bonita Creek. With the discovery of Green Sunfish in 2009, the Bureau of Land Management (BLM), Safford Field Office (SFO), initiated mechanical removal since retreatment of the stream with piscicides was deemed not feasible due to habitat complexity (likely the reason the first treatment failed), public perception, and permitting requirements.

The removal effort of Green Sunfish varied over the years and was largely dependent on funding and personnel availability. In 2016, increased funding from the BLM Washington Office and the Bureau of Reclamation's Gila River Basin Native Fishes Conservation Program provided for the hiring of a dedicated removal crew. This allowed for more than doubling our overall effort in 2016 compared to 2015. This increased effort reduced Green Sunfish numbers to the point that recruitment was effectively eliminated, and by September 2018 they were no longer detectable. A total of 24,107 Green Sunfish were removed from a 1.9-mile reach of lower Bonita Creek (Table 1). Removal efforts are now targeting Yellow Bullhead.

The results for Bonita Creek suggest that in systems isolated either naturally or with a barrier, nonnative mechanical removal can be effective in eliminating or reducing the numbers of nonnative fish species. The timing of the removal effort to reduce the number of spawning adults is equally important as the amount of effort expended. Underestimating the effort needed, funding constraints, and lack of personnel are the primary reasons it took nine years to eliminate Green Sunfish from Bonita Creek.

Methods for Bonita Creek: Approximately 1.9 miles of lower Bonita Creek were divided into 16 zones based on low-water road crossings, starting from the constructed fish barrier (Zone 0, UTM 641579E, 3642074N) and extending upstream to the City of Safford's infiltration gallery (Zone 16, UTM 640173E, 3645545N) (Figure 1). These zones were established to facilitate data recording and analysis.

Over the years, various gear types have been employed to capture nonnative Yellow Bullhead, including hoop nets, Gee metal minnow traps, and Krey Traps™. However, the primary techniques currently used are backpack electrofishing (Smith-Root, LR-20B) and Promar traps (0.3 m diameter, 0.6 and 0.9 m long, double throat, 1.2 cm mesh), due to their proven effectiveness.

Promar Traps

Promar traps are baited with wet and dry dog food or catfish bait to attract and increase the catch rate of Yellow Bullhead. Traps are set during the daytime and left to fish overnight. The time of deployment and retrieval is recorded, although effort is summarized as the number of traps set regardless of the actual fishing time. To prevent non-target animals from drowning, traps are set with air pockets.

Backpack Electrofishing

Initially, the presence of extensive and deep beaver dam pools within Bonita Creek posed significant challenges to the effective use of electrofishing due to the depth and complexity of the habitat. However, monsoonal flooding in 2022 reduced the number of these beaver dam pools, enhancing the accessibility and efficiency of electrofishing in previously difficult-to-reach sections of the creek. This technique has proven particularly effective in segments of the stream that have become more accessible post-flooding.

All captured species were identified, classified as either juvenile or adult, and enumerated. Native species included Gila Chub, Longfin Dace, Speckled Dace, Gila Topminnow, Sonora Sucker, Desert Sucker, and Sonora Mud Turtle (*Kinosternon sonoriense*). Nonnative species encountered included Fathead Minnow, Western Mosquitofish, and Yellow Bullhead. The presence of the American Bullfrog (*Rana catesbeiana*) was noted as either present or absent.

Total length (TL) measurements in millimeters (mm) were recorded for Yellow Bullhead. Individuals with TL $\geq$ 140 mm were classified as adults, while those with TL < 140 mm were classified as juveniles.

All nonnative fish species were placed in a bucket and euthanized with an overdose of tricaine methanesulfonate (MS-222). They were then discreetly placed away from the creek and visitors in a debris pile or buried. Non-target native species were returned to the water immediately at or near the point of capture to minimize impacts on them.

Results for Bonita Creek: In 2024, nineteen removal trips, totaling 51 days, were conducted from March through December. During this period, 965 Yellow Bullhead were removed by backpack electrofishing and 644 by Promar® traps (Table 2). Total electrofishing effort was 208,339 seconds

(3,472 minutes or 58 hours). Estimated Yellow Bullhead biomass removed by backpack electrofishing totaled 22,537 grams (g). Promar® trap effort was 1,011 net nights. Estimated Yellow Bullhead biomass removed by Promar® traps totaled 31,177 g. Of the 1,600 Yellow Bullhead removed, juveniles comprised 68% (n=1,091), adults comprised 32% (n=508), and a Yellow Bullhead of unknown age comprised 0.1% (n=1). The Yellow Bullhead of unknown age was inadvertently placed in the bucket with the processed Yellow Bullhead, making it impossible to differentiate and measure.

Furthermore, 14 Yellow Bullhead were removed during the annual fish monitoring in April and are not included in Table 2. Of these, five were collected below the fish barrier and nine above. Length-frequency histograms of Yellow Bullhead removed from Bonita Creek in 2024, using Promar traps and backpack electrofishing, show multiple age classes of Yellow Bullhead (Figure 2).

Recommendations for Bonita Creek:

1. **Continued Yellow Bullhead Removal in 2025**: The removal efforts will persist throughout 2025 with multiple monthly removal trips, concentrating initially on the upper reaches of Bonita Creek. These areas currently support fewer Yellow Bullhead compared to the lower reaches. Removal efforts will gradually move downstream as CPUE approaches zero and areas are deemed cleared.

2. **Utilize Effective Techniques**: Continue using backpack electrofishing and Promar traps as the primary removal techniques. These methods have proven effective, especially considering recent habitat changes due to monsoonal flooding.

3. **Community and Stakeholder Engagement**: Engage with local communities, stakeholders, and environmental groups to foster support for the removal efforts. Educational initiatives can help raise awareness about the importance of maintaining habitat devoid of nonnative species.

Recovery Goals/Objectives for Aravaipa Creek Fish: Nonnative fish removal of piscivorous Yellow Bullhead from Aravaipa Creek will help protect and secure genetic lineages of two of the rarest endemic fishes of the Gila River basin, Loach Minnow (*Tiaroga cobitis*) and Spikedace (*Meda fulgida*) and address the following recovery goals identified for each species in their respective recovery plans.

Recovery Objectives for Loach Minnow:

Loach Minnow and Spikedace recovery plans (1991)

Task 5. Enhance or restore habitats occupied by depleted populations.

Loach Minnow recovery objective 5.1 Identify target areas amenable to management.

Loach Minnow recovery objective 5.2 Determine necessary habitat and landscape improvements. This includes removal or other control of nonnative fishes, where they are problematic.

Loach Minnow recovery objective 5.3 Implement habitat improvement. This includes repeated management to remove nonnatives.

Task 6. Reintroduce populations to selected streams within historic range.

Loach Minnow recovery objective 6.2.2 Enhance habitat, as necessary.

Loach Minnow recovery objective 6.2.3 Assess status of nonnative fishes in watershed.

Loach Minnow recovery objective 6.2.5 Reclaim as necessary to remove non-native fishes.

Recovery Objectives for Spikedace:

Loach Minnow and Spikedace recovery plans (1991)

Task 5. Enhance or restore habitats occupied by depleted populations.

Spikedace recovery objective 5.1 - Identify target areas amenable to management.

Spikedace recovery objective 5.2 - Determine necessary habitat and landscape improvements. This includes depletion or removal of nonnative fishes, if identified as significant deterrents to survival or enhancement of Spikedace.

Spikedace recovery objective 5.3 - Implement habitat improvement. This includes repeated management to remove nonnatives.

Task 6. Reintroduce populations to selected streams within historic range.

Spikedace recovery objective 6.2.3 - Assess status of non-native fishes in the watershed.

Spikedace recovery objective 6.2.5 - Reclaim as necessary to remove non-native fishes.

Geographical Area: Aravaipa Creek is a tributary to the San Pedro River and is in southeastern Arizona about 50 miles west of Safford, Arizona, along the border of Graham and Pinal counties. The creek becomes perennial at Aravaipa Spring near Stowe Gulch on lands owned and managed by The Nature Conservancy (TNC) and flows west to the San Pedro River approximately 22-miles. The watershed covers 558 square miles and includes multiple tributaries, some which contribute flow to the mainstem. Landownership is comingled with private, federal, and tribal inholdings. The two primary managers/landowners, BLM and The Nature Conservancy are supportive of the project. Permission to remove Yellow Bullhead from private lands on the west end is ongoing with permission granted so far from 18 of the 19 landowners contacted.

Background for Aravaipa Creek: Aravaipa Creek is recognized as one of the premier native fish assemblages in the state, supporting seven populations of native fish species, including Loach Minnow, Spikedace, Roundtail Chub (*Gila robusta*), Speckled Dace, Longfin Dace, Sonora Sucker, and Desert Sucker. An eighth species, the Gila Topminnow, was stocked in 2022 by the Arizona Game and Fish Department and The Nature Conservancy (TNC) on TNC land. It is too early to determine if they will persist and establish a population, although they have been captured approximately six miles downstream of their stocking location.

Nonnative predatory and competitive fish, such as Yellow Bullhead and Red Shiner (*Cyprinella lutrensis*), inhabit the mainstem of Aravaipa Creek and pose a threat to the native fish species. A third nonnative fish species, Green Sunfish, was successfully removed from Horse Camp Canyon, a tributary to Aravaipa Creek, by the Bureau of Land Management (BLM) Safford Field Office (SFO) and partners using various gear types, including Promar nets, Gee metal minnow traps, dipnets, seines, and backpack electrofishers, from 2010 to 2015. With the elimination of the source population of Green Sunfish from Horse Camp Canyon, the BLM SFO and partners initiated the removal of Yellow Bullhead and any remaining Green Sunfish from Aravaipa Creek in 2017, as nonnative fish are the greatest threat to the native fish community in this system. Future invasions of nonnative fish from the San Pedro River are unlikely due to paired fish barriers constructed by the Bureau of Reclamation (BOR) in 2001.

The purpose of this task is to remove nonnative fish species, specifically Yellow Bullhead and Red Shiner, from Aravaipa Creek to protect the existing native fish community. Although all nonnative species prey upon and compete with the native species, removal efforts will primarily focus on habitats occupied by Yellow Bullhead, including pools, backwaters, and streambank margins. By targeting these habitats, the impacts on federally endangered Loach Minnow and Spikedace will be minimized. Red Shiner will not be directly targeted, as their habitat preferences tend to overlap with those of Loach Minnow and Spikedace.

Methods for Aravaipa Creek: Aravaipa Creek was divided into 79, 500-meter (m) segments, starting from the lower constructed fish barrier (S001, UTM 534676E, 3634081N) upstream to Stowe Gulch (S079, UTM 559509E, 3636784N) (Figure 3). These segments facilitated the recording and analysis of data. One or two teams, consisting of a backpack electrofisher (Smith-Root model LR-24 or 20B) and one or two dip netters, collected fish by shocking along both banks during the sampling days. Electrofishing effort (seconds [s]) was recorded for each segment.

All likely Yellow Bullhead habitats, including slow-moving pools, woody debris, vegetation, and undercut banks, were sampled. When a Yellow Bullhead was encountered, the location was repeatedly sampled with the electrofisher until no additional individuals were captured. We stopped recording capture localities for each Yellow Bullhead in 2021 to expedite the removal process. Pool and backwater habitats were sampled using a backpack electrofisher, seine, or both. Nonnative fish were placed in a bucket, euthanized with MS-222, enumerated, and measured (total length [TL] in millimeters). Non-targeted native species, including the Lowland Leopard Frog, were returned to the water immediately at or near the point of capture to minimize impacts on them.

Results for Aravaipa Creek: In 2024, 16 removal trips that spanned 50-days and covered 174 stream segments (*i.e.*, 87 river kilometers) were conducted at Aravaipa Creek (Table 6). Total electrofishing effort was 629,446 seconds (10,491 minutes or 175 hours), resulting in the capture of 13,030 Yellow Bullhead. Estimated Yellow Bullhead biomass removed totaled 280,110 grams (g) (Table 7). An additional 76 Yellow Bullhead not included in Table 7 were removed during the spring and fall fish monitoring for a total of 13,106. Of the 13,106 Yellow Bullhead captured, juveniles comprised 86% (n=11,217), and adults comprised 14% (n=1,889) of the total catch.

Table 7 shows that September had an exceptionally higher number of Yellow Bullhead removed and biomass compared to the other months. This higher catch rate in September could be due to several factors, including the presence of larger fish that are easier to see and capture than smaller ones, drought-induced low water levels, and changes in water temperature or food availability. Additionally, variations in the amount and type of aquatic vegetation can affect fish distribution and concentration, making them more susceptible to capture and leading to higher catch efficiency.

Catch per unit effort (CPUE) was calculated for both the number of Yellow Bullheads captured and their estimated biomass. The number of Yellow Bullheads removed, not including those captured during fish monitoring, in 2024 (n=13,030) was 4,458 more than in 2023 (n=8,572), representing a 52% increase in removals and reflecting increased fishing effort (Table 8). Yellow Bullhead biomass totaled 280,110 grams, with juveniles comprising 127,161 grams and adults 152,949 grams, despite juveniles comprising 86% of the total catch.

A length-frequency histogram of Yellow Bullhead removed in 2024 from Aravaipa Creek, excluding those collected during fish monitoring, illustrates multiple ages classes with juvenile Yellow Bullhead being the highest proportion (Figure 4).

It is anticipated that the substantial removal of juvenile fish in 2024 will reduce the overall reproductive capacity of the population and as the removal efforts continue in 2025, the skewed age distribution is expected to contribute to a decline in Yellow Bullhead.

The absence of flooding from 2020 through 2024, coupled with low flows, facilitated the growth of nonnative watercress (*Nasturtium officinale*) in the creek, creating pockets of ideal habitat for juvenile Yellow Bullhead. The daily maximum mean discharge from 2015 through 2024 is illustrated in Figure 5.

Recommendations for Aravaipa Creek:

1. **Continued Yellow Bullhead Removal in 2025:** Removal efforts will continue throughout 2025 with bimonthly trips. These trips will be divided between the east and west ends of Aravaipa Creek with a focus on habitat located within the wilderness using an upstream-to-downstream approach.

2. **Utilize Effective Techniques:** Backpack electrofishing will remain the primary method due to its proven effectiveness at Aravaipa Creek. Overnight sets of Promar traps may be attempted in habitats adjacent to or near campsites.

3. **Community and Stakeholder Engagement**: Continue to support participation from local landowners, community members, and environmental organizations in the removal efforts.

Acknowledgement: The work described in this report was partially funded through Interagency Agreement (Nos. R22PG00016) with U.S. Bureau of Reclamation as part of the Central Arizona Project (CAP) Gila River Basin Native Fishes Conservation Program. Additional funding was received from the Bureau of Land Management, Aquatic Resources Program.

Literature Cited

Schneider, J. C., P. W. Laarman, and H. Gowing. 2000. Length-weight relationships. Chapter 17 in Schneider, J. C., editor. 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

U.S. Fish and Wildlife Service. 1991a. Spikedace Recovery Plan. Albuquerque, New Mexico. 38 pp.

U.S. Fish and Wildlife Service. 1991b. Loach Minnow Recovery Plan. Albuquerque, New Mexico. 38 pp.

U.S. Fish and Wildlife Service. 2015. Gila chub (Gila intermedia) Draft Recovery Plan. U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico. 118 pp. + Appendices A-C.

Weedman, D. A. 1999. Gila topminnow, *Poeciliopsis occidentalis occidentalis*, revised recovery plan. Draft. August 1999. U.S. Fish and Wildlife Service, Phoenix, AZ.

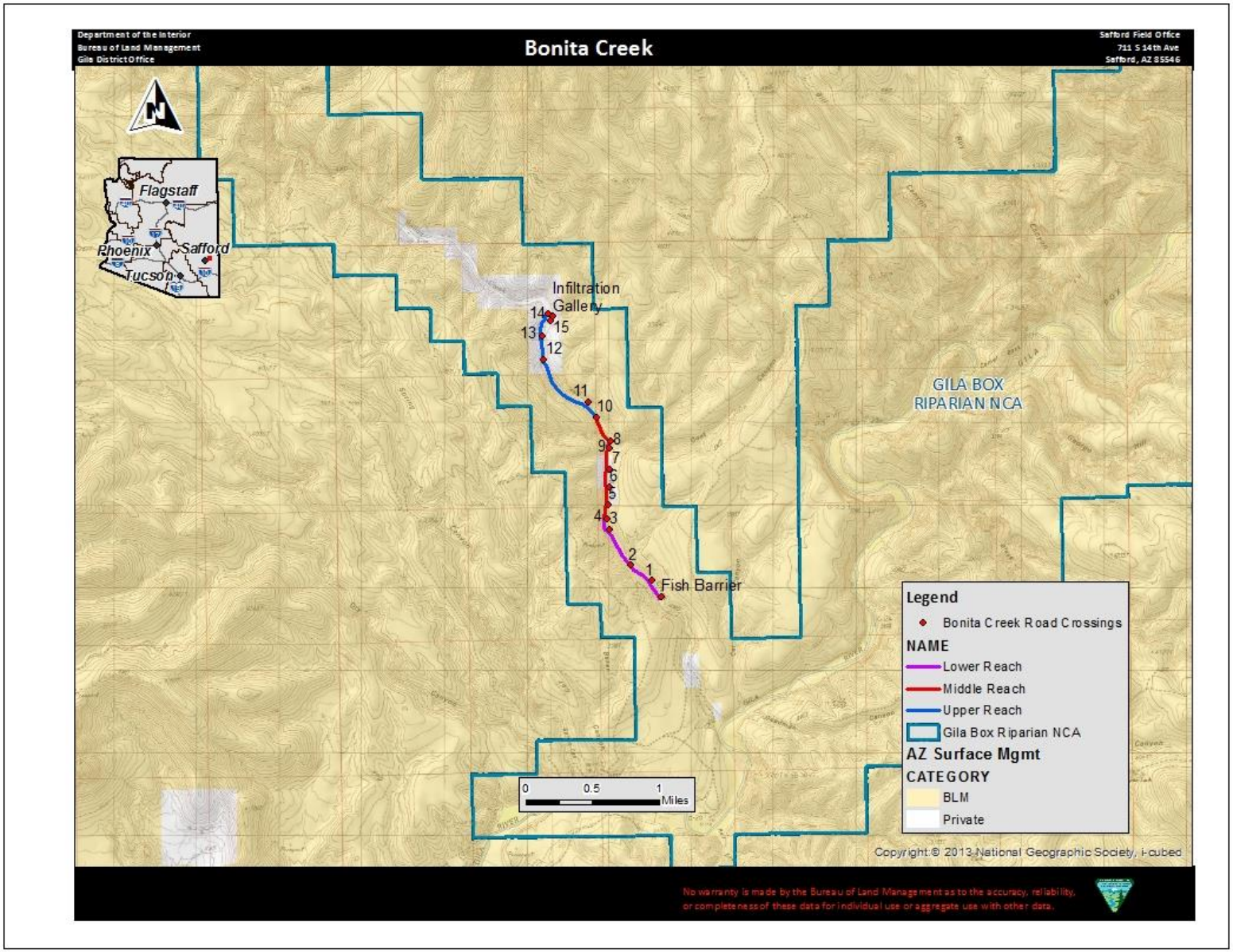

Figure 1. Project area showing fish barrier, low water road crossings, City of Safford infiltration gallery, and stream reaches of Bonita Creek.

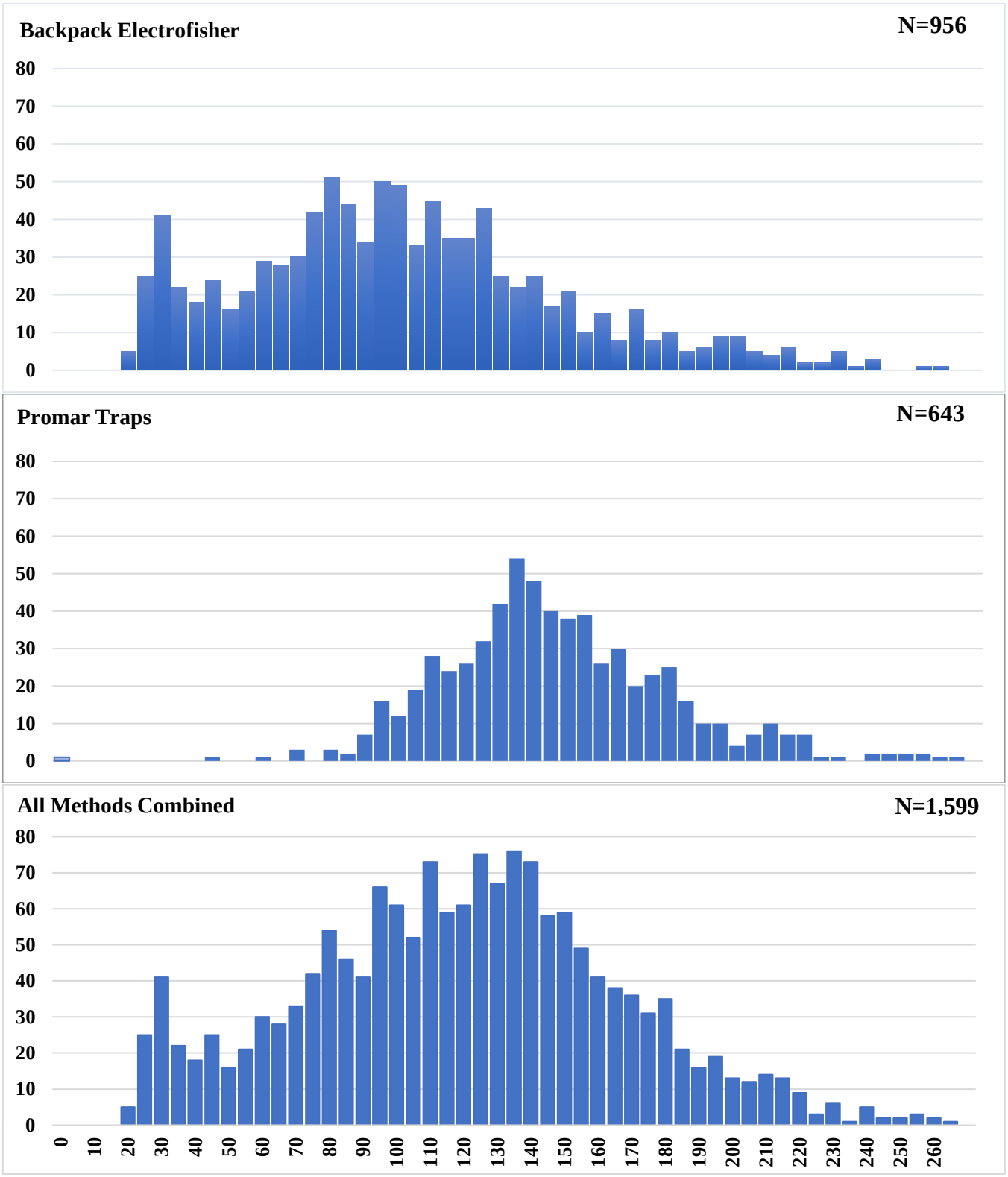

Figure 2. Length frequency histograms of Yellow Bullhead removed from Bonita Creek using backpack electrofisher, Promar traps, and all methods combined in 2024.

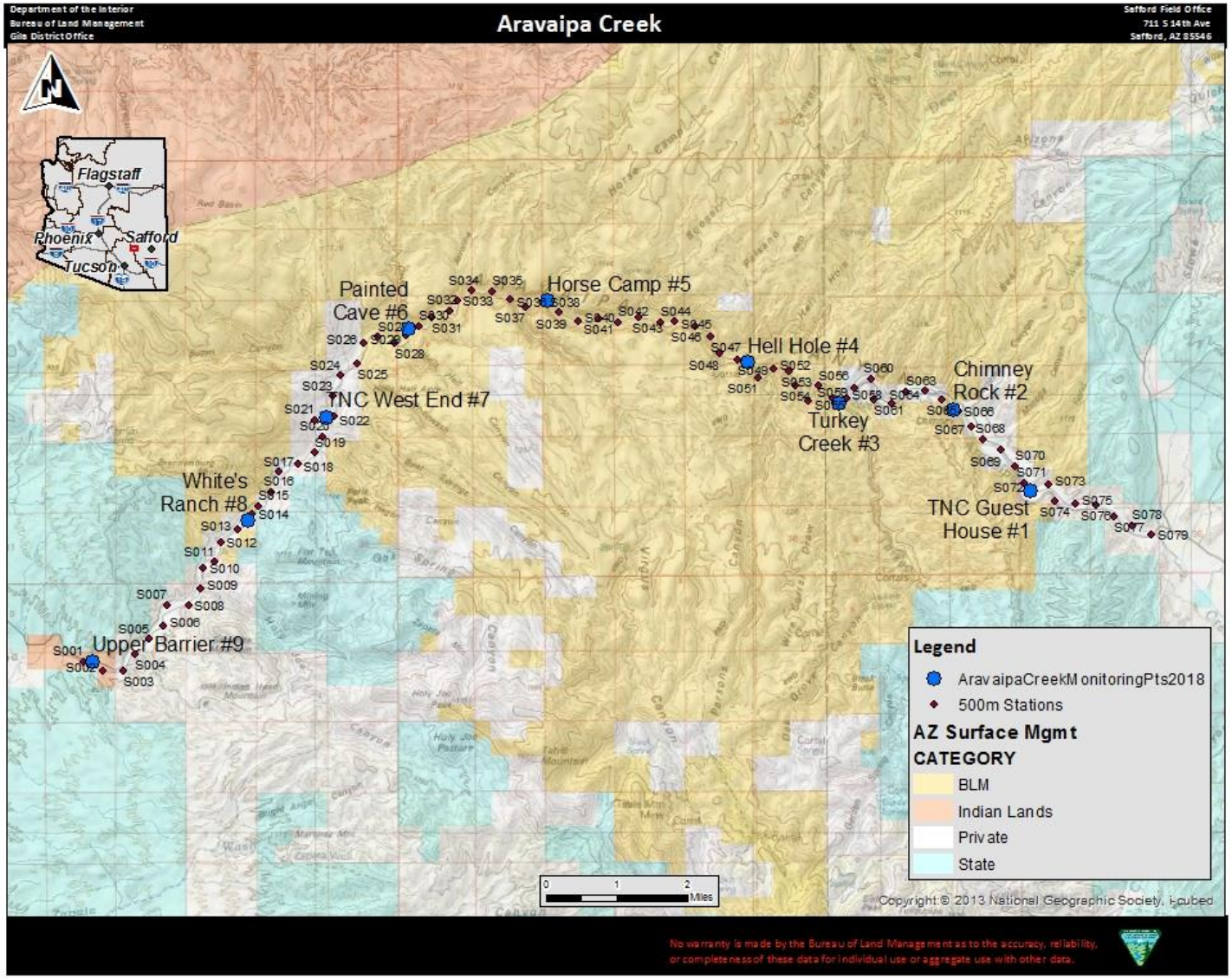

Figure 3. Project area showing the 79, 500-meter reaches and permanent fish monitoring sites of Aravaipa Creek.

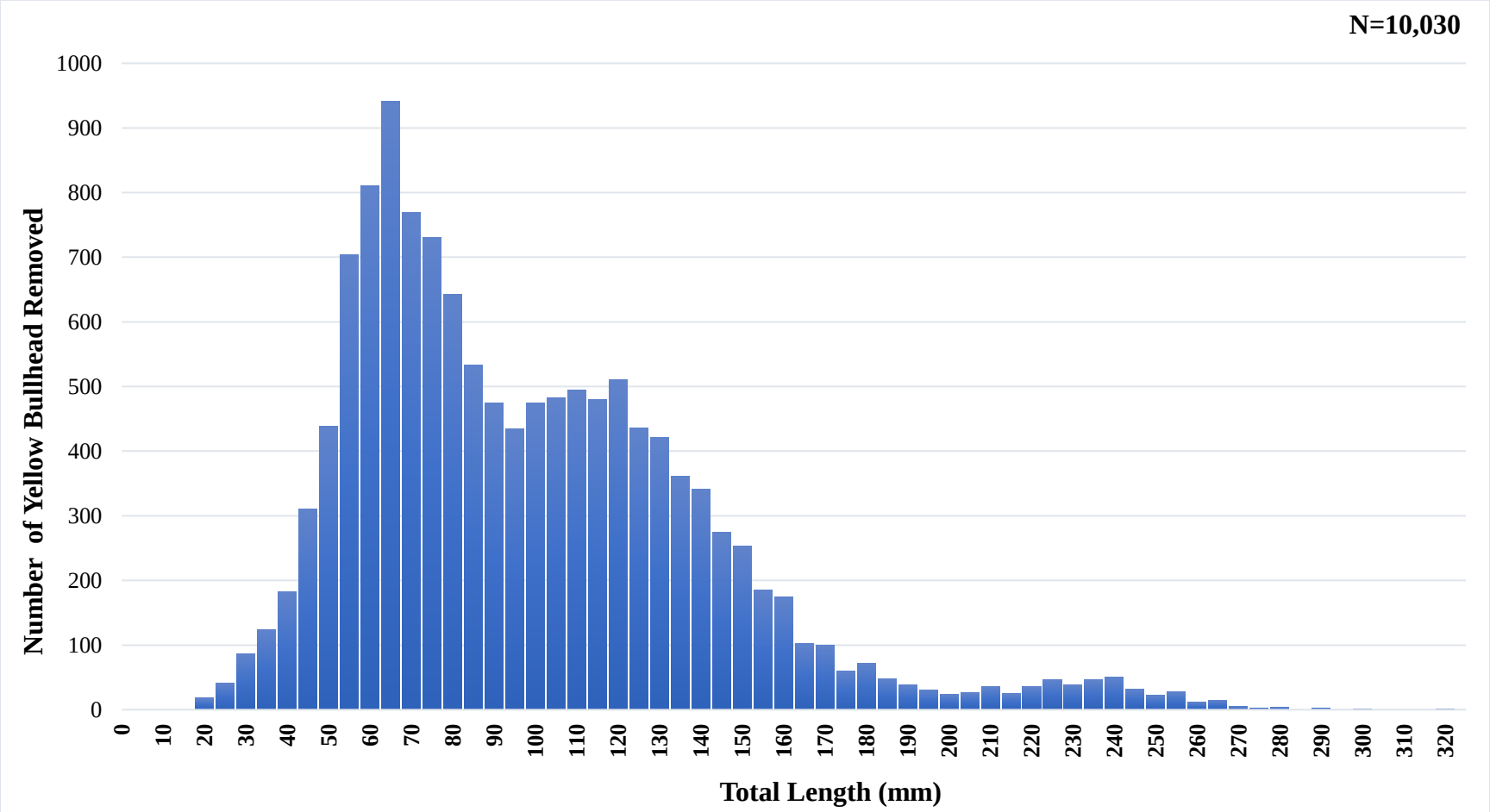

Figure 4. Length frequency histogram of Yellow Bullhead catch from Aravaipa Creek, February-December 2024.

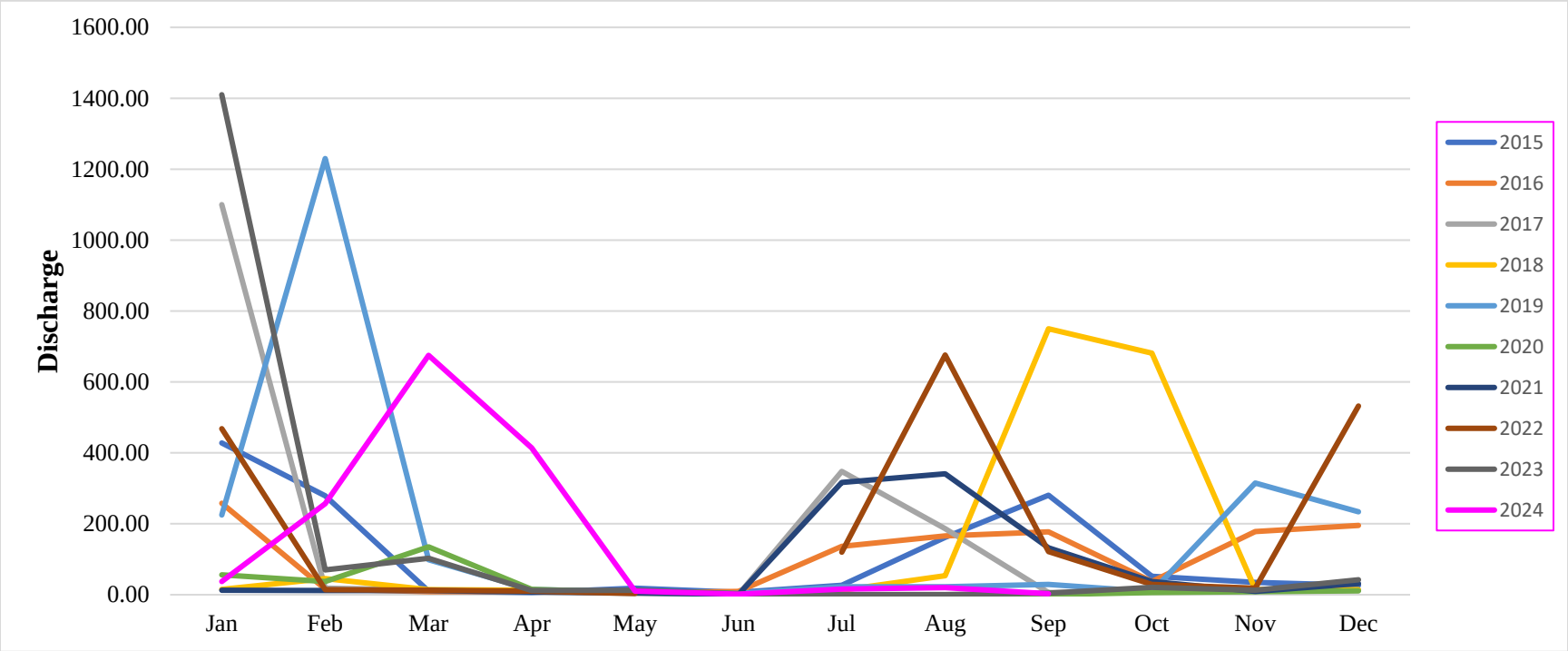

Figure 5. Daily maximum mean discharge in cubic feet per second in Aravaipa Creek (Mammoth, AZ stream gage) from 2015 through 2024. *Please note that the US Geological Survey station at Aravaipa Creek is missing data from September through December.

Table 1. Catch summary of Green Sunfish removed from Bonita Creek by gear type, 2009-2024.

Gear Type	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018-2024	Total
Gee Minnow Trap	350	1,688	2,324	3,701	1,152	2,278	1,329	2,815	2		15,639
Promar Net	614	566	832	1,623	857	521	574	576	5		6,168
Hoop Net			76	224	148	198	204	126			976
Gee and Promar - Combined			756								756
Straight Seine					186			12			198
Seines/Dipnets	173										173
Dip Net					93						93
Red Promar	11				4			42			57
Backpack Electrofisher	10	8	10			2					30
Tote Barge Shocker						7					7
Custom Trap						8	1				9
Crab Trap					1						1
Total	1,158	2,262	3,998	5,548	2,441	3,014	2,108	3,571	7	**0**	**24,107**

Table 2. Summary of Yellow Bullhead removed from Bonita Creek in 2024 using Promar traps and Backpack electrofishing.

Zone ID	Number of Yellow Bullhead Removed	
	Promar	BPS
Between Fish Barrier and 1st Road Crossing	257	61
Road Crossing 1-2	52	260
Road Crossing 2-3	175	386
Road Crossing 3-4	15	30
Road Crossing 4-5	5	15
Road Crossing 5-6	14	17
Road Crossing 6-7	31	9
Road Crossing 7-8	0	18
Road Crossing 8-9	DRY	
Road Crossing 9-10	DRY	
Road Crossing 10-11	0	17
Road Crossing 11-12	62	138
Road Crossing 12-13	27	4
Road Crossing 13-14	6	1
Total by Method	644	956
Total All Methods Combined	**1,600**	

Table 3. Summary of Yellow Bullhead removal by backpack electrofisher from Bonita Creek in 2024.

Month	Number of Yellow Bullhead Removed	Effort by Month (Minutes)	Estimated Biomass (g) Removed by Month	CPUE (#AMNA/Minute)	CPUE (Biomass/Minute) by Month
March	167	675	4978	0.25	7.37
April	127	733	3,270	0.17	4.46
May	189	423	6,137	0.45	14.50
July	237	484	3,555	0.49	7.34
August	182	782	3,520	0.23	4.50
September	26	257	550	0.10	2.14
October	28	118	527	0.24	4.45
Total	956	3,473	22,537	0.28	6.49

Table 4. Summary of Yellow Bullhead removal by Promar Traps from Bonita Creek in 2024.

Month	Number of Yellow Bullhead Removed	Effort by Month (Net Night)	Estimated Biomass (g) Removed by Month	CPUE (#AMNA/Net Night)	CPUE (Biomass/Net Night) by Month
March	12	15	527	0.80	35.13
April	45	62	3,013	0.73	48.60
May	164	84	5,774	1.95	68.73
July	140	114	5,481	1.23	48.07
August	107	153	4,654	0.70	30.42
September	26	75	1,288	0.35	17.17
November	117	340	7,618	0.34	22.40
December	33	168	2,824	0.20	16.81
Total	644	1,011	31,177	0.64	30.84

Table 6. Summary table of Yellow Bullhead removal from Aravaipa Creek in 2024.

Removal Date	Location	Distance Covered (river kilometers)	Number of Yellow Bullhead Removed	Effort (Seconds)
02/26-29/2024	West-end	6	585	35,940
03/18-21/2024	East-end	5	640	29,011
04/22/2024	East-end	1.5	82	7,491
04/30/2024	East-end	2	265	10,156
05/01-02/2024	East-end	4.5	437	17,037
05/06-09/2024	West-end	8	489	37,277
06/03-06/2024	West-end	6.5	783	39,551
06/24-27/2024	East-end	7	933	67,779
07/22-25/2024	West-end	6.5	1,640	80,079
08/12-15/2024	West-end	6.5	1,930	76,977
08/26/2024	East-end	0.5	68	5,537
09/3-6/2024	East-end	6.5	1,602	56,048
09/23-26/2024	East-end	8	1,260	47,050
09/30-10/03/2024	West-end	7	1,639	55,826
10/21-24/2024	East-end	9.5	604	54,289
12/10/2024	West-end	2	73	9,398
Total		**87**	**13,029**	**629,446**

Table 7. Catch, estimated biomass, effort, and biomass CPUE by month of Yellow Bullhead from electrofishing at Aravaipa Creek (2024).

Month	**Number of Yellow Bullhead Removed**	**Estimated Biomass Removed by Month**	**Effort by Month (Minutes)**	**CPUE (Biomass/Minute) by Month**
February	585	8962	599	14.96
March	640	10535	484	21.77
April	347	8161	294	27.76
May	926	32710	905	36.14
June	1716	49477	1789	27.66
July	1640	30531	1335	22.87
August	1998	27259	1375	19.82
September	3289	73175	1932	37.88
October	1816	36891	1621	22.76
December	73	2408	157	15.34
	13,030	280,110	10,491	26.70

*Biomass of yellow bullhead removed was calculated using the length to weight formula from (Schneider *et al*., 2000).

Table 8. Summary of Yellow Bullhead catch per unit effort by number per minute and by biomass per minute for juveniles and adults from Aravaipa Creek by backpack electrofisher from 2018 through 2024.

Year	Age Class	Count	Minutes	Biomass (g)	CPUE (#AMNA/minute)	CPUE (grams/minute)
2018	J	117	651	2,356	0.18	3.62
2018	A	116	651	14,043	0.18	21.59
2019	J	75	508	1,132	0.15	2.23
2019	A	43	508	4,888	0.08	9.61
2020	J	2,048	3224	22,167	0.64	6.88
2020	A	733	3224	67,449	0.23	20.92
2021	J	2,628	6991	39,716	0.38	5.68
2021	A	1,389	6991	121,117	0.20	17.32
2022	J	371	955	5,683	0.39	5.95
2022	A	572	955	44,559	0.59	46.66
2023	J	7,048	4029	45,790	1.75	11.36
2023	A	544	4029	62,027	0.14	15.39
2024	J	11,149	10491	127,161	1.06	12.12
2024	A	1,881	10491	152,949	0.18	14.58