



Nonnative Fish Removal from Aravaipa and Bonita Creeks 2021 Annual Report

Interagency Agreement (R17PG00018 and R18PG00115) Between Bureau of Reclamation
And
Bureau of Land Management, Safford Field Office

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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 (*Poeciliopsis 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 and 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 is a mixture of federal, city, tribal, and private lands. From the reservation boundary downstream, BLM, SFO manages approximately 92% of the lands and the remaining 8% are City of Safford and private holdings. The two managers/landowners, Bureau of Land Management (BLM), Safford Field Office (SFO), and City of Safford are supportive of the project.

Background for Bonita Creek: In 2008, Bureau of Reclamation (BOR) through the Gila River Basin Native Fishes Conservation Program, constructed a fish barrier across lower Bonita Creek to prevent upstream incursion of nonnative aquatic species from the Gila River into lower and upper segments of Bonita Creek as part of a multi-agency native fish restoration project to protect the extant 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, 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 (which is likely the reason the first treatment failed), public perception, and permitting requirements.

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 allowed for the hiring of a dedicated removal crew that was able to more than double our overall effort in 2016 from 2015. This increased effort reduced Green Sunfish numbers to a point that recruitment was effectively eliminated by September 2018 as they were no longer detectable. A total of 23,282 Green Sunfish were removed from a 1.9-mile reach of lower Bonita Creek (Table 1).

The results for Bonita Creek suggest that in systems that are isolated either naturally or with a barrier, nonnative mechanical removal can be effective in either eliminating or reducing the numbers of nonnative fish species. The importance of timing the removal effort to reduce the number of spawning adults is equally as 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 15 segments based on low-water road crossings from the constructed fish barrier upstream to the City

of Safford's infiltration gallery (Figure 1). These segments were used to separate effort for data recording and analysis.

A variety of gear types, including collapsible Promar traps (0.3 m diameter, 0.6 and 0.9 m long, double throat, 1.2 cm mesh), Gee metal minnow traps (25 cm diameter, 47 cm long, double throat, 0.6 or 0.3 cm mesh), and hoop nets (0.7 m diameter, 1.2 m long, two-hoop, single throat, 0.6 cm mesh) have been used since 2018 to optimize removal efforts. However, starting in February 2021, we eliminated Gee metal minnow traps and hoop nets as they have proven to be ineffective in catching Yellow Bullhead. Additionally, a new trap, 6-hole collapsible Krey Traps™ (0.3 m high, 0.5 m long, 0.95 m across, 8 sided with 6 holes, 0.3 x 0.3 cm mesh), was assessed during the July 2021 removals for its effectiveness in catching Yellow Bullhead.

Promar traps along with Krey Traps™ were baited with wet and dry dog food to attract fish and increase catch. Traps were set in daytime and fished overnight. Time of deployment and retrieval of traps were recorded, but effort was summarized as trap sets regardless of the actual time fished. Traps were set with air-pockets to prevent non-targeted animals from drowning.

All species captured were identified, classified as either juvenile or adult, and enumerated. Native species captured 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 (*Pimephales promelas*), Western Mosquitofish (*Gambusia affinis*), and Yellow Bullhead (*Ameiurus natalis*). American Bullfrog (*Rana catesbeianus*) was recorded as present or absent. Total length (TL) measurements in millimeters (mm) were recorded for Yellow Bullhead. Yellow Bullhead ≥ 140 mm TL was classified as adult or if < 140 TL was classified as juvenile.

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

Results for Bonita Creek: Eight removal trips were conducted from February through July 2021 and 563 Yellow Bullhead were removed (Table 2). An additional seven Yellow Bullhead were removed during annual fish monitoring in May. A length-frequency histogram of all the fish removed from Bonita Creek in 2021 depict several age classes of Yellow Bullhead including young-of-year fish less than 50 mm TL, juveniles between 50-139 mm TL, and adults 140 mm TL or greater (Figure 2).

Recommendations for Bonita Creek: Yellow Bullhead removal will continue in 2022. The number of removal trips will be increased due to additional funding from the BLM Washington Office and from a National Fish and Wildlife Foundation grant. Additional funding will allow for monthly removal trips that will focus on the upper reaches, which support fewer Yellow Bullhead than lower reaches, and will continue downstream as CPUE approaches zero and areas are cleared. Movement of Yellow Bullhead from downstream into upstream removal reaches is difficult, if not impossible, due to beaver dams that act as barriers to upstream fish movement.

ARAVAIPA CREEK ANNUAL REPORT

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 located in southeastern Arizona about 50 miles west of Safford, Arizona, along the border of Graham and Pinal counties (Figure 3). The creek becomes perennial at Aravaipa Spring near Stowe Gulch on lands owned and managed by The Nature Conservancy 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 in progress with permission granted so far from 18 of the 19 landowners contacted.

Background for Aravaipa Creek: Considered one of the premiere native fish assemblages in the state, Aravaipa Creek (Figure 3) supports seven populations of native fish species, including Loach Minnow, Spikedace, Roundtail Chub (*Gila robusta*), Speckled Dace, Longfin Dace, Sonora Sucker, and Desert Sucker. Additionally, nonnative predatory and competitive fishes, including Yellow Bullhead and Red Shiner (*Cyprinella lutrensis*) inhabit the mainstem of Aravaipa Creek and threaten the native fishes. A third nonnative fish species, Green Sunfish, was successfully removed from Horse Camp Canyon, a tributary to Aravaipa Creek, by BLM, SFO and partners using a variety of 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 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 fishes from the San Pedro River are unlikely due to paired fish barriers that were constructed in 2001 by BOR.

The purpose of this task is to remove nonnative fishes, Yellow Bullhead, Green Sunfish, and Red Shiner from Aravaipa Creek to protect the extant native fish community. Although all species prey upon and compete with the native species, removal efforts will focus primarily on habitats occupied by Yellow Bullhead and Green Sunfish, which includes pools, backwaters, and streambank margins. By focusing on these habitats, impacts to federally endangered Loach Minnow and Spikedace will be minimal. Red Shiner will not be targeted directly since their habitat preferences tend to overlap with both 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). These segments were used to separate effort for data recording and analysis. One or two teams consisting of a backpack electrofisher (Smith-Root model LR-24 or 20B) and one or two dip netters collected fishes by shocking along both banks for the days sampled. Electrofishing effort (seconds [s]) was recorded for each segment sampled. All likely Yellow Bullhead habitat was sampled and included slow-moving pools, woody debris, vegetation, and undercut banks. When a Yellow Bullhead was encountered, the location was repeatedly sampled with the electrofisher until no additional individuals were captured. We stopped recording capture locality for each yellow bullhead in 2021 to expedite the removal process. Pool and backwater habitats were sampled with a backpack electrofisher, seine, or both and occasionally

with traps. When traps were used, their location was marked with a UTM coordinate or conspicuously identified if no GPS signal was available. They were baited with wet and/or dry dog food and set for a maximum of two hours. Nonnative fish were placed in a bucket, euthanized with MS-222, enumerated, and measured (TL in mm). Non-targeted native species, including Lowland Leopard Frog were returned to the water immediately at or near the point of capture to minimize impacts to them.

Results for Aravaipa Creek: The BLM, SFO and partners conducted five removal trips in 2021. Two removal trips were for Interagency Agreement (R17PG00018) and three were for (R18PG00115). One-hundred and forty-two stream segments, totaling approximately 51.5 river kilometers were sampled in 2021. A total of 4,017 Yellow Bullhead (Table 3) and two adult Green Sunfish were removed by electrofishing. Young-of-Year (YOY) Yellow Bullhead comprised 0.1% (n=3) of total catch, juveniles comprised 65.3% (n=2,625), and adults comprised 34.6% (n=1,389). An additional 23 Yellow Bullhead were removed during the spring (n=10) and fall (n=13) 2021 bi-annual fish monitoring for a total of 4,040 Yellow Bullhead (Table 4).

A length-frequency histogram of Yellow Bullhead removed (excluding those collected during fish monitoring) from Aravaipa Creek in 2021 depict several age classes including young-of-year fish less than 50 mm TL, juveniles from 50-139 mm TL, and adults 140 mm TL or greater (Figure 4).

Although it is still too early to draw any conclusions on the effect that Yellow Bullhead removal efforts are having, preliminary analysis of Catch-Per-Unit-Effort (CPUE) for number and biomass of AMNA removed is showing promising results with CPUE (fish/minute) decreasing from 0.86 in 2020 to 0.57 in 2021. Additionally, CPUE for biomass (grams/minute) is also showing a slight decrease from 28.0 in 2020 to 23.0 in 2021 (Table 5).

Lack of flooding in 2020 and 2021 and low flows have allowed for nonnative watercress (*Nasturtium officinale*) to increase in both width and length along both streambanks providing ideal and difficult habitat to remove Yellow Bullhead from. Current discharge at Aravaipa Creek based on the Mammoth, Arizona stream gauge is 11 cubic feet per second (cfs), which is about 24% below the seasonal average for this time of year. Daily maximum mean discharge from 2015 through 2021 is shown in Figure 5.

Recommendations for Aravaipa Creek: Yellow Bullhead removal will continue in 2022. The number of removal trips will be increased due to additional funding from the BLM Washington Office and from a National Fish and Wildlife Foundation grant. Additional funding will allow for bimonthly removal trips that will be split between the east and west ends. Removal trips will focus on habitats in the wilderness and with an upstream to downstream approach. Backpack electrofishing will be the primary gear type used due to its proven effectiveness at Aravaipa Creek. Additionally, overnight sets for Promar traps may be attempted in habitats adjacent or nearby campsites.

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Literature Cited

- 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.

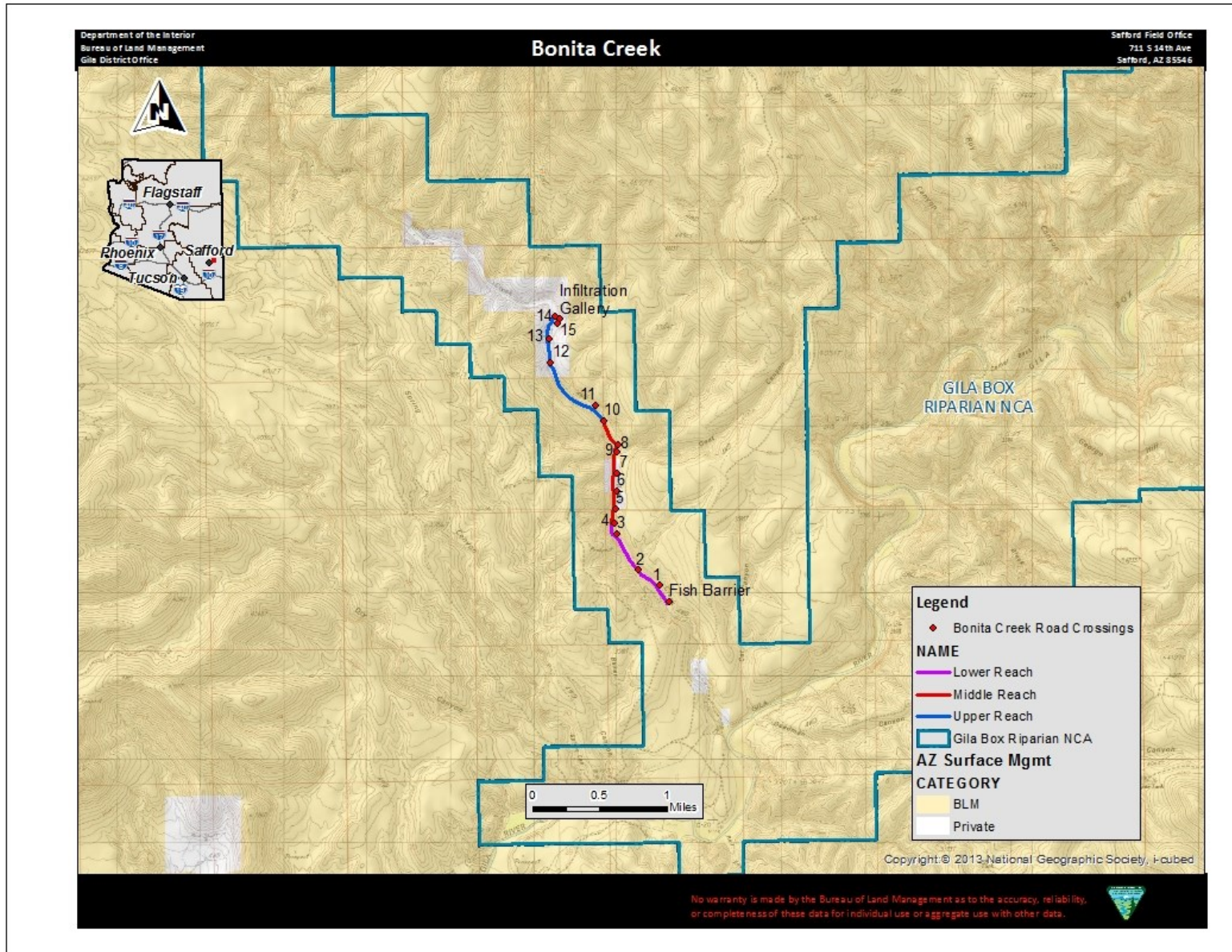


Figure 1. Project area showing fish barrier, low water road crossings, City of Safford infiltration gallery, and stream reaches of Bonita Creek.

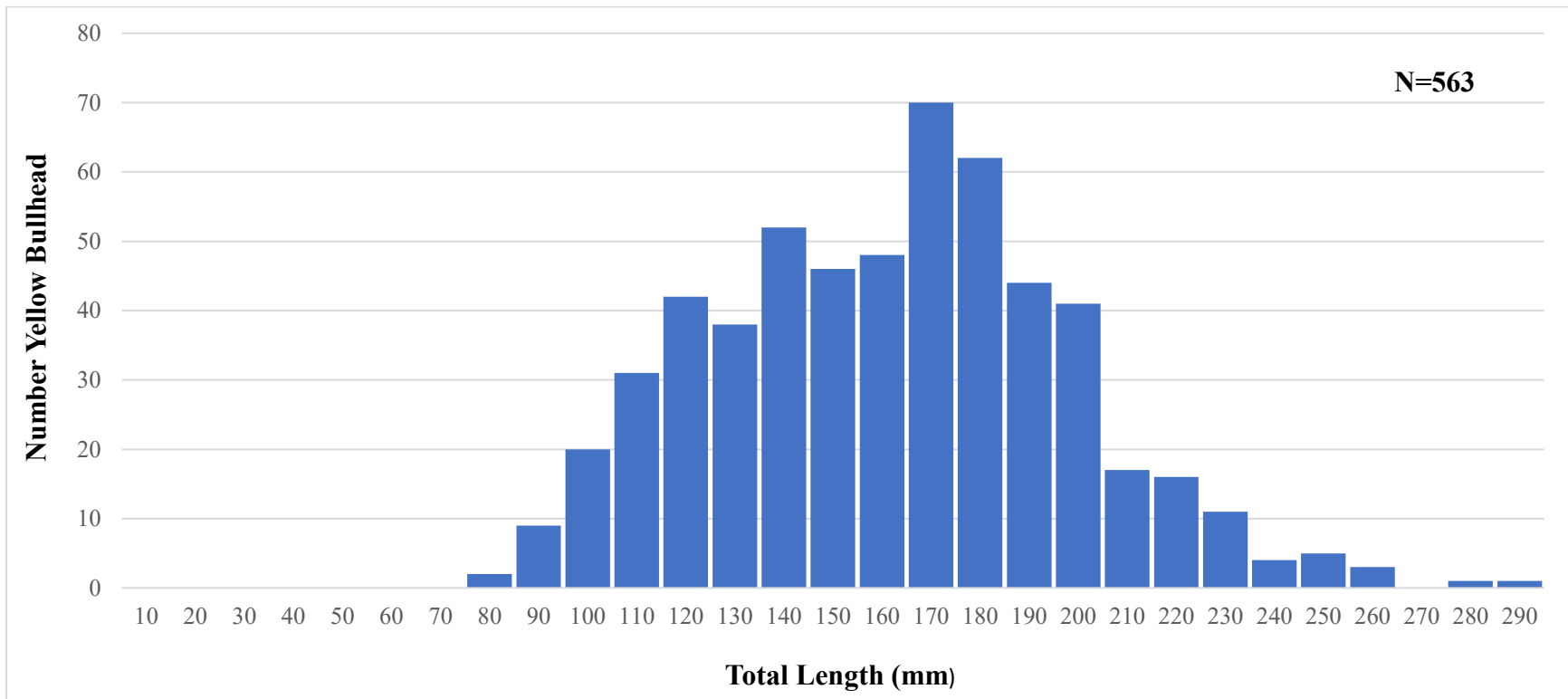


Figure 2. Length frequency histogram of Yellow Bullhead catch in Bonita Creek, January-September 2021.

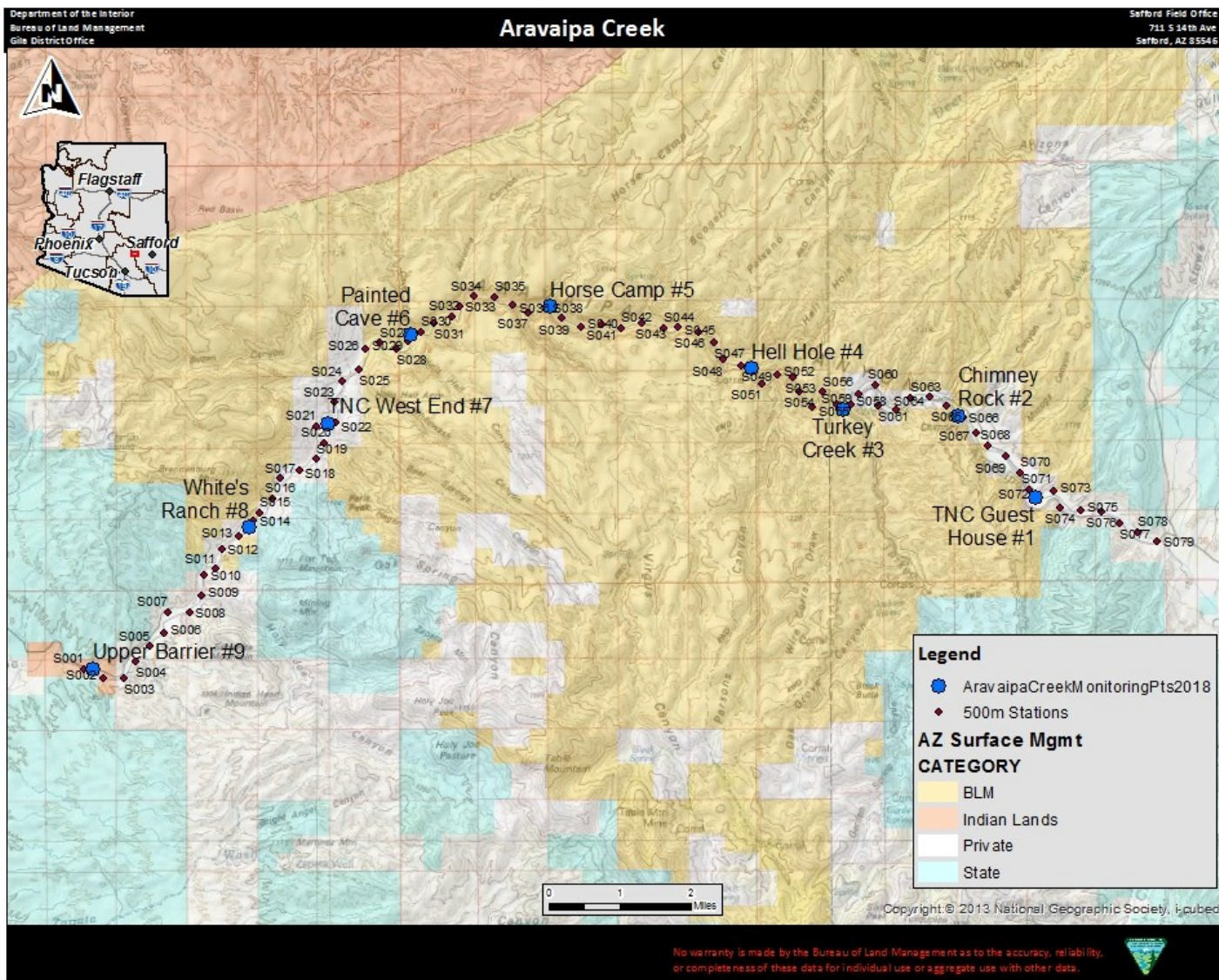


Figure 3. Project area showing 500-meter reaches and permanent fish monitoring sites of Aravaipa Creek.

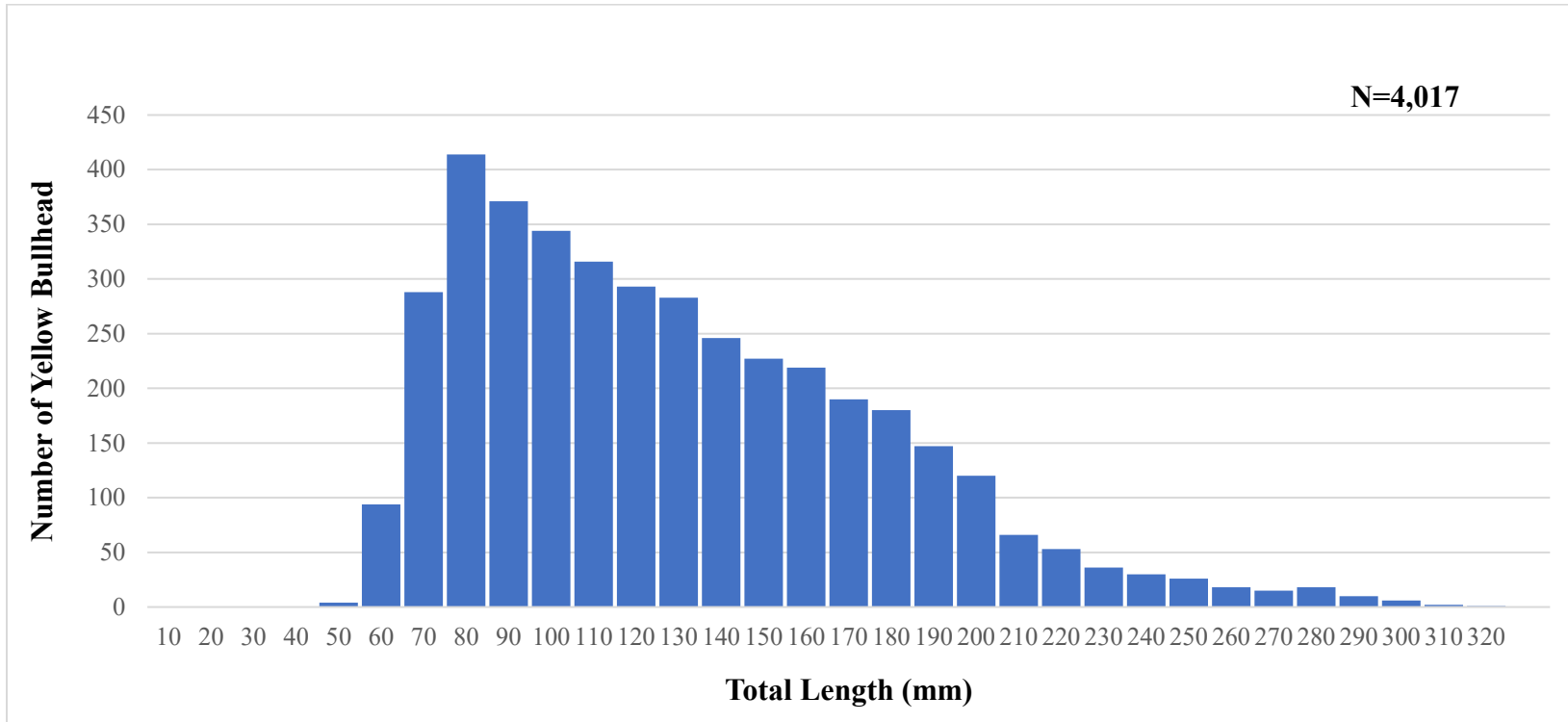


Figure 4. Length frequency histogram of Yellow Bullhead catch in Aravaipa Creek, March-August 2021.

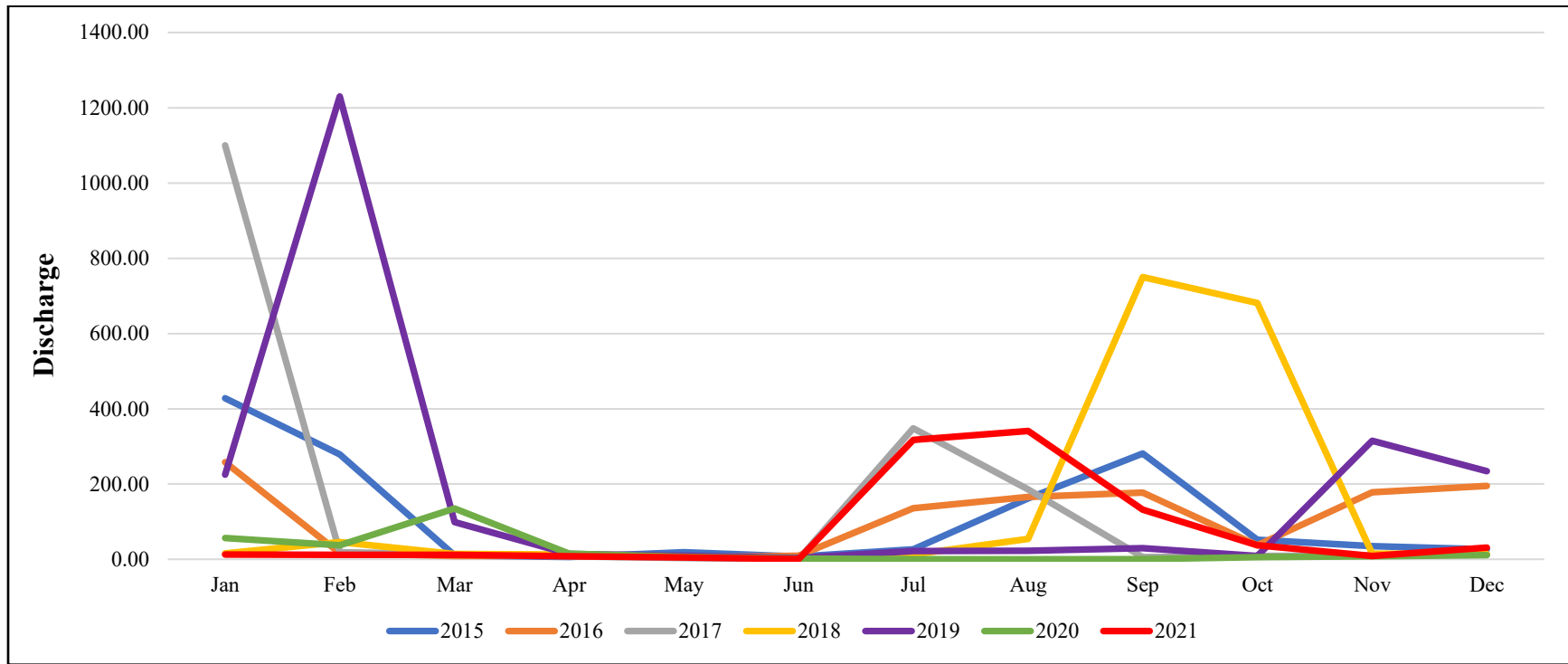


Figure 5. Daily maximum mean discharge in cubic feet per second [in Araviapa Creek \(Mammoth, AZ stream gage\)](#) from 2015 through 2021.

Table 1. Gear type and total number of Green Sunfish removed from Bonita Creek, 2009-2021.

Gear Type	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018-2021	Total
Gee Minnow Trap	137	1,647	2,323	3,701	1,152	2,278	1,329	2,815	2		15,384
Promar Net	155	471	820	1,623	857	521	574	576	5		5,602
Hoop Net			76	224	148	198	204	126			976
Gee and Promar - Combined			756								756
Seine	173				186			12			371
Dip Net					93						93
Red Promar	7				4			42			53
Backpack Electrofisher	10	8	10			2					30
Tote Barge Shocker						7					7
Custom Trap						8	1				9
Crab Trap					1						1
Total	482	2,126	3,985	5,548	2,441	3,014	2,108	3,571	7	0	23,282

Table 2. Summary of Yellow Bullhead removal from Bonita Creek in 2021.

Removal Date	Location – Road Crossings	Krey Trap Effort (net night)	Promar® Effort (net night)	Number of Yellow Bullhead Captured by Net and CPUE			
				Krey Trap	CPUE	Promar®	CPUE
2/22-23/2021	12-13 and 13-14	0	139	0	0	50	0.36
2/23-24/2021	12-13	0	139	0	0	27	0.19
6/7-8/2021	12-13 and 13-14	0	70	0	0	22	0.31
6/8-9/2021	11-12	0	125	0	0	131	1.05
6/9-10/2021	11-12	0	137	0	0	81	0.59
7/26-27/2021	11-12, 12-13, 13-14, 14-15, 15-gallery	2	171	1	0.5	126	0.74
7/27-28/2021	11-12, 12-13, 13-14, 14-15	2	171	0	0	69	0.40
7/28-29/2021	11-12, 12-13, 13-14, 14-15	2	171	2	1.0	54	0.32
Total		6	1,123	3	1.5	560	3.96

Table 3. Yellow Bullhead effort, catch, and biomass per segment by electrofishing in Aravaipa Creek, 2021.

Date	Segment	Effort(s)	Catch	Estimated Biomass (g)*
3/22/2021	S001	3197	10	426
	S002	3419	10	963
	S003	2722	13	635
	S004	4559	8	599
	S005	2757	5	70
3/23/2021	S005 (pool)	140	7	78
	S006	1165	0	0
	S007	2582	1	102
	S008	2382	2	107
	S009	4184	14	924
	S010 (partial)	2929	21	1250
3/24/2021	S011 (partial)	2630	17	725
	S012	5196	27	1119
	S013	5901	24	1446
3/25/2021	S014	5994	21	777
	S015	4147	24	1415
	S016	2694	11	300
	S017	3569	19	757
	S018	2653	9	480
3/30/2021	S019	3260	3	176
	S020	2344	6	155
	S021	2213	7	329
	S022	1739	4	122
	S023	1382	14	241
	S027	2249	10	773
	S028	2641	31	1203
	S029	2752	40	2396

	S030	2643	34	1064
	S031	2766	66	2600
	S032	2208	41	1570
	S033	1421	29	950
	S034	5053	60	4530
	S035	5193	36	1231
	S036	7098	26	687
	S037	6607	9	637
	S038	5550	33	2709
	S039	3985	53	2509
	S041	4949	21	423
	S049	7100	20	368
	S050	6648	101	1678
	S051	2284	5	196
	S057	3281	7	186
	S058	2817	8	262
	S059	2724	16	396
	S060	5003	18	573
3/31/2021	S024	2045	8	199
	S025	1604	10	139
	S026	1948	21	758
	S027	1353	2	39
	S028	835	6	206
	S029	3543	17	636
	S030	3480	27	1099
	S031	3599	50	1492
	S032	3890	55	2314
	S033	2117	46	1984
	S034	5440	48	1145
	S035	5855	32	1079

	S036	2674	13	546
	S037	2679	14	1308
	S038	2750	26	1631
	S039	2289	25	438
	S040	5550	30	1455
	S042	3921	12	343
	S043	4508	36	1487
	S044	3420	14	645
	S045	3599	22	1485
	S046	5334	33	1129
	S047	4342	25	557
	S051	1947	32	725
	S052	5502	28	699
	S053	4045	37	589
	S054	3246	30	518
	S061	5287	11	158
	S062	5541	19	1150
	S063	5554	19	858
	S064	4334	3	27
4/1/2021	S020	1197	7	79
	S021	1031	6	160
	S022	813	3	41
	S023	723	17	711
	S024	487	4	288
	S025	1274	4	91
	S026	1498	9	74
	S027	1140	7	484
	S028	1736	24	683
	S029	1255	7	202

	S030	804	7	416
	S031	672	9	298
	S032	1059	3	92
	S033	738	5	500
	S040	2929	18	739
	S041	2805	28	486
	S042	2035	14	194
	S043	2167	46	1255
	S044	1617	12	555
	S045	1656	13	853
	S046	2165	8	398
	S047	2478	19	892
	S048	5300	36	1402
	S055	8061	59	2514
	S056	9831	73	2525
	S057	6980	33	1403
4/26/2021	S071	1294	1	13
	S072	1919	0	0
	S073	1752	1	27
4/27/2021	S043	3112	17	862
	S044	1332	6	110
	S045	1195	8	525
	S046	1078	7	194
4/28/2021	S047	2006	10	520
	S048	2868	28	785
4/29/2021	S049	2983	17	831
	S050	3544	64	2174
	S051	4522	55	1626
5/24/2021	S023	2926	67	2053

	S024	2864	39	1198
5/25/2021	S025	2876	32	750
	S026	2689	48	1301
	S027	2843	58	2589
	S028	3201	29	1299
5/27/2021	S029	1848	33	1388
	S030	1584	35	1354
	S031	2821	38	1434
5/26/2021	S032	3365	23	615
	S033	2161	21	778
	S034	1681	23	1988
8/23/2021	S023	1781	87	4034
	S024	1140	40	2462
	S025	1330	60	3061
	S026	1337	39	1640
8/24/2021	S027	1547	85	3822
	S028	1719	104	3562
	S029	2000	78	3070
	S030	1863	88	3316
	S031	2593	110	5648
8/25/2021	S032	1871	73	3118
	S033	2190	92	4021
	S034	1764	59	2557
8/26/2021	S035	2427	120	4839
	S036	1831	67	3205
	S037	2025	88	3330
	S038 (partial)	165	4	425
Totals:	142	419,459	4,017	160,834

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

Table 4. Summary of Yellow Bullhead removal from Aravaipa Creek from March through October 2021.

Removal Date	Location	Distance Covered (river kilometers)	Effort (Seconds)	Number of Yellow Bullhead Removed	Number of Green Sunfish Removed	Comments
3/22-25/2021	West End	9.0	62,820	243		
3/30-4/01/2021	West End	23.0	270,592	1,920	2	
4/9-10/2021	East & West Ends	-	-	10		Collected during spring fish monitoring
4/26-29/2021	West End	6.0	27,605	214		
5/24-27/2021	East End	6.0	30,859	446		
8/23-26/2021	East End	7.5	27,583	1,194		
10/8-9/2021	East End	-	-	13		Collected during fall fish monitoring
Total		51.5	419,459	4,040	2	

Table 5. Summary of Yellow Bullhead removal from Aravaipa Creek from March through October 2021.

Year	Age Class	Count	Seconds	Minutes	Biomass (g)	CPUE (#AMNA/Minutes)	CPUE (grams/per minute)
2018	J	117	39,032	650.533	2,356	0.18	3.62
2018	A	116	39,032	650.533	14,043	0.18	21.59
2019	J	75	30,503	508.383	1,132	0.15	2.23
2019	A	43	30,503	508.383	4,888	0.08	9.61
2020	J	2048	193,448	3224.13	22,167	0.64	6.88
2020	A	733	193,448	3224.13	67,449	0.23	20.92
2021	J	2628	419,459	6990.98	39,716	0.38	5.68
2021	A	1389	419,459	6990.98	121,117	0.20	17.32