



Nonnative Fish Removal from Bonita and Aravaipa Creeks 2019 Annual Report

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

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

2. 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.

3. 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:

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

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

Recovery Objectives for Gila Topminnow:

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.

3. Recovery Goals/Objectives for Aravaipa Creek Fish:

Nonnative fish removal from Aravaipa Creek will help secure populations of 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:

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:

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.

3. Background for Bonita Creek: In 2008, 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, the Bureau of Reclamation (BOR) 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 (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 were discovered in the renovated portion of Bonita Creek, 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. 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

Methods: Nonnative fishes were mechanically removed from a 1.9-mile reach of lower Bonita Creek that extends from the constructed fish barrier upstream to the City of Safford's Infiltration gallery.

A variety of gear types, including collapsible Promar nets, Gee metal minnow traps, hoop nets custom and crab traps, dipnets, backpack electrofisher (LR-24), tote barge shocker, and seines, were used to optimize removal efforts. All traps and nets were baited with Purina Dog Chow to attract fish and increase catch.

All species collected were identified and enumerated; nonnative Green Sunfish and Yellow Bullhead were measured in millimeters and enumerated. Green Sunfish ≥ 65 mm total length (TL) were classified as adult, whereas fish < 65 mm TL were classified as juvenile. Yellow Bullhead ≥ 140 mm TL were classified as adult, whereas < 140 TL were classified as juvenile.

To make the removal process more manageable, we divided the creek into 14 segments based on the low water road crossings and three reaches (lower, middle, and upper). The lower reach extended from the fish barrier upstream to road crossing 4, middle reach included road crossing 4 upstream to road crossing 10, and the upper reach included road crossing 10 upstream to road crossing 15.

Results/ Discussion: Eradication of Green Sunfish began August of 2009 with their discovery and ended September 4, 2018. A total of 23,282 Green Sunfish were removed from Bonita Creek (Table 1). Although a variety of different gear types were used to eradicate Green Sunfish, the majority, 21,742 were captured in standard Gee metal minnow traps and large Promar nets. Gee metal minnow traps captured 15,384 of the Green Sunfish, Promar nets captured 5,602, and a mix of Promar nets and Gee metal minnow traps that were not differentiated captured 756, which took an effort of 47,034 net sets. The remaining 1,540 Green Sunfish were captured with ancillary gear types.

Effort 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.

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.

Mechanical removal of Yellow Bullhead began in 2011 with their discovery and follows removal techniques and strategies used for Green Sunfish. Four-thousand, one-hundred and eighty Yellow Bullhead were removed from May 2011 through December 2019 and is ongoing (Table 2).

4. Results for Bonita Creek: A total of six removal trips were conducted from February through November 2019. No Green Sunfish were collected or observed (Table 2). Summary of catch and effort by trip is provided below.

February 11-12, 2019: Seven-five Promar Nets and 75 Gee metal minnow traps were set between road crossings 1 and 2. Forty-two Yellow Bullhead, six Mosquitofish, 161 Fathead Minnow, seven Sonora Sucker, and four Gila Chub were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

July 15-16, 2019: Fifty Promar Nets and 50 Gee metal minnow traps were set between road crossings 1 and 2. Eighty-two Yellow Bullhead, 54 Mosquitofish, 182 Fathead Minnow, five Sonora Sucker, and four Gila Chub were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

July 15-16, 2019: Fifteen Promar Nets and 15 Gee metal minnow traps were set between road crossings 2 and 3. Seventeen Yellow Bullhead, 160 Mosquitofish, 11 Fathead Minnow, and two Gila Chub were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

July 16-17, 2019: Twenty-five Promar Nets and 25 Gee metal minnow traps were set between road crossings 2 and 3. Twenty-seven Yellow Bullhead, 284 Mosquitofish, four Fathead Minnow, two Sonora Sucker, and six Gila Chub were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

July 29-30, 2019: Thirty Promar Nets and 30 Gee metal minnow traps were set between road crossings 2 and 3. Eighty-nine Yellow Bullhead, 188 Mosquitofish, 17 Fathead Minnow, six Sonora Sucker, 60 Gila Chub, and two Gila Topminnow were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

November 11-12, 2019: Fifteen Promar Nets and 15 Gee metal minnow traps were set between road crossings 2 and 3 in the upper section. Nine Yellow Bullhead, one Mosquitofish, one Fathead Minnow, seven Sonora Sucker, 57 Gila Chub, and three Gila Topminnow were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

November 11-12, 2019: Fifty Promar Nets and 50 Gee metal minnow traps were set between road crossings 3 and 4. Four Yellow Bullhead, one Mosquitofish, six Fathead Minnow, 20 Sonora Sucker, 217 Gila Chub, and one Gila Topminnow were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

November 13-14, 2019: Thirty-two Promar Nets and 32 Gee metal minnow traps were set between road crossings 4 and 5. Fifteen Yellow Bullhead, three Fathead Minnow, eight Sonora Sucker, and 97 Gila Chub were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

November 13-14, 2019: Forty-three Promar Nets and 43 Gee metal minnow traps were set between road crossings 5 and 6. Twenty-six Yellow Bullhead, one Fathead Minnow, 27 Sonora Sucker, 244 Gila Chub, and one Sonora Mud turtle (*Kinosternon sonoriensis*) were captured. All nonnative fish captured were humanely euthanized with an overdose of tricaine methanesulfonate (MS-222).

5. Recommendations for Bonita Creek: The Yellow Bullhead population in Bonita Creek appear to be distributed in a pattern like how Green Sunfish were distributed, with numbers higher in the lower reaches than in the upper reaches. I recommend targeting removals prior to spawning in March and April and monthly removals in 2020 and 2021 to eradicate Yellow Bullhead from Bonita Creek.

Background for Aravaipa Creek: Considered one of the premiere native fish assemblages in the state, Aravaipa Creek (Figure 2) supports seven native species, including Roundtail Chub (*Gila robusta*), Speckled Dace, Longfin Dace, Loach Minnow, Spikedace, 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 were 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. A total of 3,910 green sunfish and one yellow bullhead were removed from Horse Camp Canyon. Most Green Sunfish, 2,675 (68%) were captured in traps and nets, 1,125 (29%) were removed by seining, 105 (3%) were captured with an aquarium dipnet, and five (less than one percent) by backpack electrofishing. Zero Green Sunfish were captured in 2013, four were captured in 2014, three in 2015, and zero were captured in 2018. If all removal methods are combined, juvenile Green Sunfish comprised 43% (n=1,676) of total catch, adults comprised 40% (n=1,555), and 679 (17%) were unknown.

With the successful removal of Green Sunfish, the BLM, SFO and partners-initiated removal of Yellow Bullhead from Aravaipa Creek in 2017 as nonnative fish are the greatest threat to the native fish community in this system.

The purpose of this task is to remove nonnative fishes, Yellow Bullhead and Red Shiner from Aravaipa Creek to protect the extant native fish community. Although both species prey upon and compete with the native species, removal efforts will focus primarily on habitats occupied by Yellow Bullhead, 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.

The Bureau of Land Management, Safford Field Office and partners have conducted nine removal efforts since September 2017, resulting in 674 Yellow Bullheads removed. Additionally, Yellow Bullhead have been captured and removed during Loach Minnow and Spikedace hatchery augmentation collections, during fish health assessments, and during backpack electrofishing demonstrations, resulting in an additional 61 Yellow Bullhead removed (Table3).

4. Results Aravaipa Creek: The Aravaipa Creek nonnative fish removal action plan was finalized in February 2019 after being reviewed by Bill Stewart and Kent Mosher, Bureau of Reclamation and Dr. Paul Marsh and Brian Kesner, Marsh and Associates. Additionally, the existing Yellow Bullhead removal datasheet was revised to facilitate data collection in the field, minimize data entry error, and improve overall data efficiency and accuracy.

Due to procedural changes and delays with Bureau of Land Management's agreement process only two Yellow Bullhead removal trips were completed in fiscal year 2019. A total of 78 Yellow Bullheads were removed. An additional 12 Yellow Bullhead were removed during other activities.

A private landowner and cooperator developed a list of private property owners along Aravaipa Creek and is assisting the BLM in obtaining permission for access across their private lands to remove Yellow Bullhead. For this effort to be successful, Yellow Bullhead will need to be removed from the entire creek, including sections which flow through private property.

5. Recommendations Aravaipa Creek: The efficacy of the 2020 Yellow Bullhead mechanical removal effort will be determined at the end of 2020 and beginning of 2021. It is currently unknown the total amount of effort required to remove Yellow Bullhead from Aravaipa Creek. We hope to gain insight into the effort required to eradicate Yellow Bullhead based on the data collected in 2020. I therefore recommend continuing nonnative removal efforts at Aravaipa Creek in 2021.

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Literature Cited

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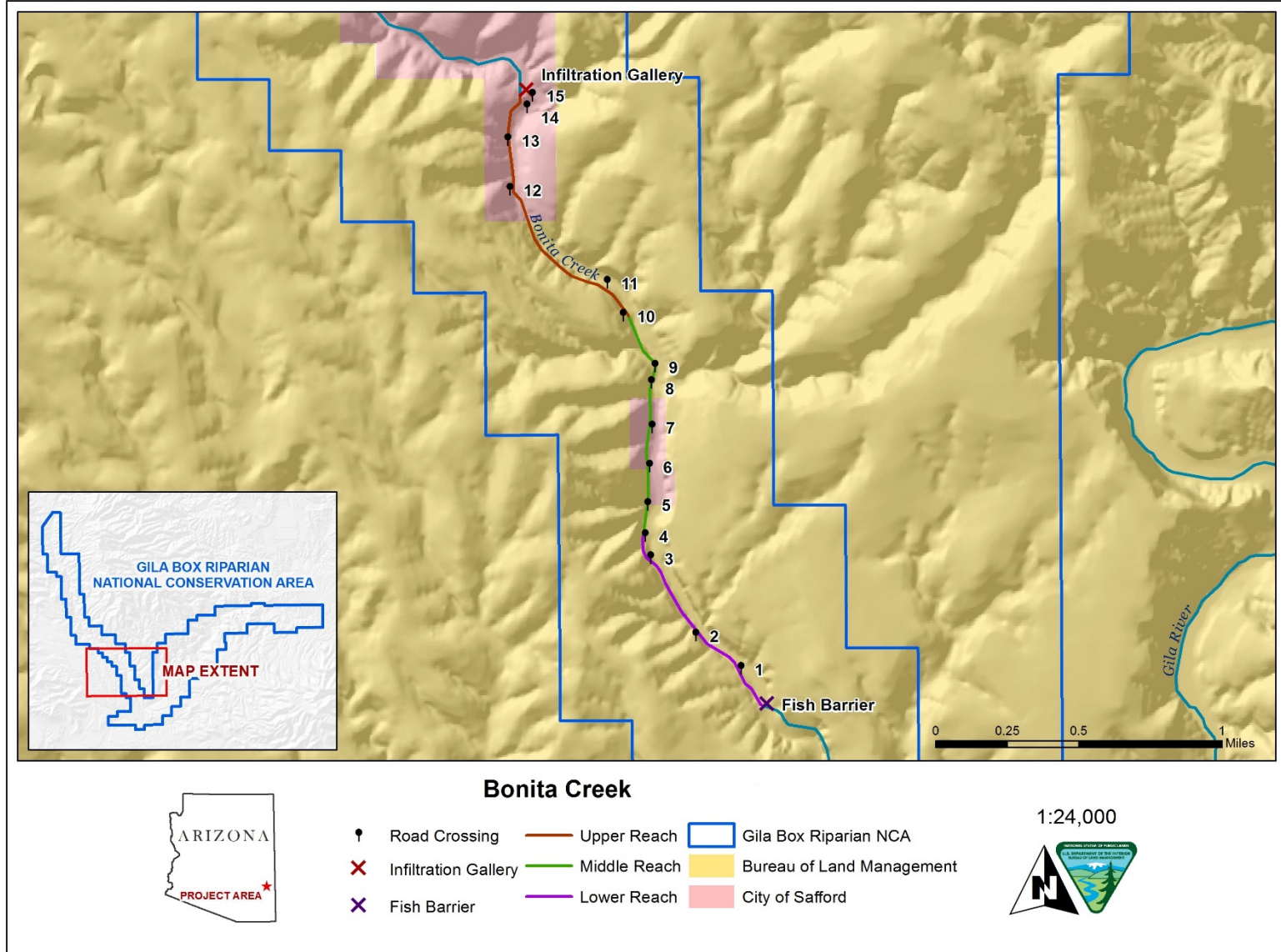


Figure 1. Map of Bonita Creek showing location of low water road crossings, City of Safford infiltration gallery, fish barrier, and reaches.

Table 1. Gear type and total number of Green Sunfish removed from Bonita Creek, 2009-2019.

Gear Type	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	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	0	23,282

Table 2. Gear type and total number of Yellow Bullhead removed from Bonita Creek, 2011-2019.

Gear Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Gee Minnow Trap	1	2	172	18	16	180	54	6	10	459
Promar Net	21	80	351	393	378	1019	325	186	299	3,011
Hoop Net						7	1			8
Seine			21			334				355
Dip Net			60							60
Red Promar			3							3
Backpack Electrofisher							242			242
Custom Trap				1						1
Total	22	82	607	412	394	1,540	622	192	309	4,180

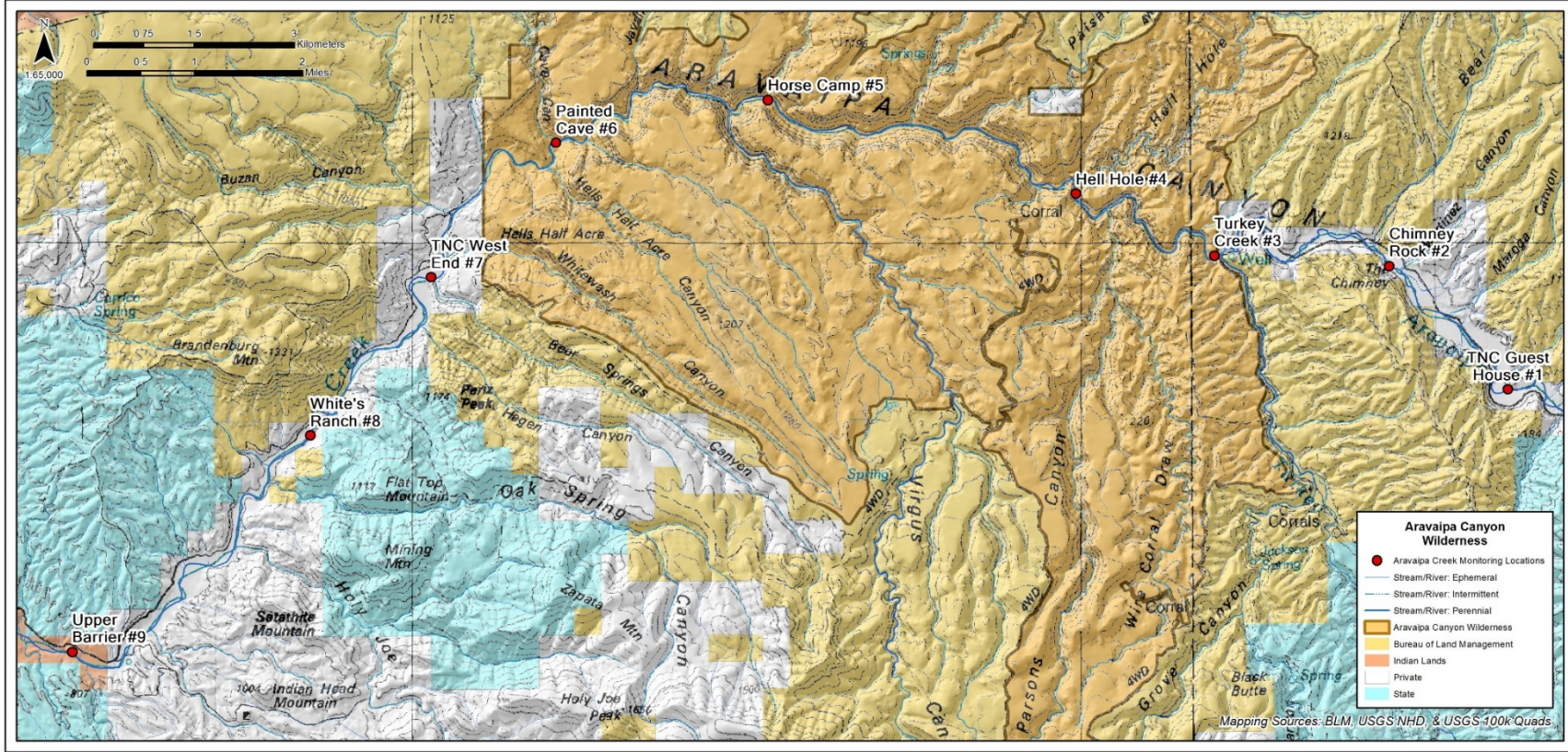


Figure 2. Map of Aravaipa Creek.

Table 3. Summary table of Yellow Bullhead removal from Aravaipa Creek from September 14, 2017 through January 14, 2020.

Removal Date	Location	Distance Covered	Effort (Seconds)	Number of Yellow Bullhead Removed	Comments
9/14/2017	East and West Ends	11.17 miles	18,360	311	
10/15/2017	West End	0.29 miles	1,222	27	Collected during a backpack electrofishing demonstration
11/6/2017	East End	0.11 miles		8	Incidental to Loach Minnow and Spikedace hatchery collection
02/26-03/01/2018	East End	8.30 miles	9,152	89	
3/13/2018	East and West Ends	4.06 miles	17,877	85	
4/15/2018	West End	0.29 miles	1,354	11	Collected during a backpack electrofishing demonstration
04/23-26/2018	East End	2.03 miles	13,198	48	
03/4-6/2019	East End	5.06 miles	19,492	17	
3/26/2019	West End	0.22 miles		12	Incidental to fish health collection
04/8-11/2019	West End	5.60 miles	12,981	61	
10/20/2019	West End			3	Collected during a backpack electrofishing demonstration
11/6/2019	West End	0.62 miles	3,274	40	
1/9/2020	West End	0.62 miles	882	2	
1/14/2020	West End	2.48 miles	3,469	21	
Total		37.75 miles	101,261	735	