

Arizona Game and Fish Department

Bear Wallow Creek Narrow-headed Gartersnake Surveys Report 2019-2020

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Background

Bear Wallow Creek is a tributary of the Black River located in the San Carlos Apache Indian Reservation (SCAR) and Apache-Sitgreaves National Forest (ASNF) Bear Wallow Wilderness Area. Bear Wallow Creek from its headwaters to confluence with the Black River and consists of a North and South forks. The creek has high conservation importance for Apache Trout (*Oncorhynchus apache*) recovery and potential establishment for Loach Minnow (*Tiaroga cobitis*). The Wallow Fire of 2011 severely affected the creek through direct fire impacts and post-fire flooding related impacts. In 2018, the lower fish barrier on the SCAR was reconstructed to render it more effective at preventing any upstream fish movement. The upper barrier located on ASNF is understood to be ineffective at completely preventing upstream movement and is planned to be removed in the future. Following the 2018 barrier improvements, a planned piscicide treatment to remove hybridized and nonnative trout upstream of the barrier, and to repatriate the creek with an assemblage of native fishes.

In 2019 and 2020 the Department conducted pre-treatment surveys for the planned piscicide treatment and also to gather data and survey effort related to the status of *Thamnophis rufipunctatus* in Bear Wallow Creek. No *T. rufipunctatus* were found in Bear Wallow in 2019 or 2020 though visual estimation surveys.

Methods

Visual Estimation Surveys (VES) were conducted to assess the presence of *T. rufipunctatus*, as well as other riparian amphibians and reptiles, throughout Bear Wallow Creek. Varying sized teams of surveyors moved along the riparian corridor at a methodical pace, primarily focusing on the stream channel and adjacent banks. Surveyors periodically moved into the nearby upland ponderosa pine habitat where potentially suitable habitat was observed or anticipated. Potentially suitable upland habitat that was focused on included areas of debris, rocks, brush, or other cover which observers could be used by snake species. Close attention was paid to cover along the streambanks, overhanging vegetation, and areas of complex habitat. Rocks and woody debris which could provide cover for snakes were flipped and then returned to their original position. Cover which could not be moved by hand was observed from multiple angles and probed with tools. Snake hooks and hiking poles were used to probe vegetation for more clear visual observation. Surveyors paid special attention to areas of complex stream habitat composed of pools, split channels, woody debris piles, and those areas which offer a concentrated diversity of habitat spatially. No trapping surveys were conducted. Electrofishing surveys are planned for August.

Surveyors who were not part of VES efforts directly related to *T. rufipunctatus* were gathering velocity and flow time data in preparation for the piscicide treatment. They were instructed to remain vigilant for any snake observations and were instructed on the proper identification between gartersnake species. These crews gathered flow data for the piscicide treatment. Crews placed fluorescent green dye in the water and mapped the location of the dye at fifteen minute intervals with GPS units for all of the flowing water in Bear Wallow Creek. The flowing dye was periodically supplemented with additional dye powder to maintain a distinct leading edge. Additionally, stream velocity measurements were taken in many locations throughout the flowing water in Bear Wallow Creek. For velocity measurements, surveyors determined the locations of these velocity transects in-situ, primarily focused on the

upstream and downstream areas of large springs or tributaries. Other locations for velocity measurements were selected based on the discretion of the surveyors and aimed for velocity measurements at every few hours of dye flow time. To collect this information, areas of the stream were selected which had smooth laminar flow and were not exceptionally wide or narrow based on the average of the stream in that area. Most transects were chosen in smooth riffle or glide stream habitat classifications with no large instream obstructions. To aid in precision of these measurements in this low velocity system, prior to measuring stream velocities, small rocks and other obstructions were temporarily moved within the transect line and also upstream and downstream one to two meters from the transect line. This was done to further homogenize the flow through that specific transect and reduce sub-surface turbulence. Rocks and debris were returned to their original locations to the best ability of the surveyors. Once a transect was chosen and smooth laminar flow was observed through dye or flowing silt, the transect was divided into ten equally spaced intervals based on the transect width. The first measurement was taken at a distance from the bank equal to half of a calculated interval. At each of the ten points along the transect, a stadia rod was used to measure depth, and a velocity measurement was taken at a depth equal to $\frac{3}{5}$ of the total depth at that point with an electronic flow-meter.

Current Habitat Conditions Observed

South Fork

The South Fork of Bear Wallow Creek remains heavily impacted from post-fire related flooding. Throughout the South Fork, riparian vegetation remains nearly absent along the entire stream corridor. The instream habitat has evidently scoured in some areas and appears to be in a slow state of recovery. Flow rates in the South Fork are very slow. Pool and deep run habitats are nearly absent and most of the instream habitat consists of shallow, wide, and slow moving riffles with limited habitat complexities. Based on current understanding of preferred habitats by narrow-headed gartersnakes (*T. rufipunctatus*) the south fork offers almost no suitable habitat.

North Fork

The instream and riparian habitat in the North Fork of Bear Wallow Creek was apparently much less affected by fire-related impacts. While the very headwaters of the North Fork experienced high intensity burns on the hillsides, which nearly eliminated all overhead canopy and the majority of the riparian vegetation, the lower riparian and instream habitats appear relatively unaffected. Lush riparian vegetation lines the banks throughout the lower North Fork, and the instream habitat remains complex with pools and runs, some more than one meter deep, and a matrix of woody debris, and braiding channels.

Undetermined trout species juveniles and adults have been observed through most of the North Fork in 2019 and 2020 surveys in the deeper pool and run habitats. No speckled dace (*Rhinichthys osculus*) or desert sucker (*Catostomus clarki*) were observed. Dozens of varying sized springs and seeps enter the North Fork throughout, but are more concentrated near the confluence with the South Fork. Some of these springs create upland marsh-like habitat on the adjacent banks before joining with the stream. These spring and seep habitats present potentially suitable habitat and refuge for neonate and juvenile snakes, along with other amphibian species. Crayfish of all size classes were observed throughout much of the North Fork Bear Wallow.



Figure 1. Two pictures depicting typical habitat conditions present in much of the lower portions of the North Fork Bear Wallow Creek. Riparian habitat appears relatively unaffected by the impacts of the Wallow Fire and contains some habitat complexities.



Figure 2. The upstream portions of the North Fork Bear Wallow experienced more visible fire-related impacts.

Bear Wallow - Mainstem

Downstream of the confluence of the North and South forks the mainstem of Bear Wallow Creek has varying levels of habitat alteration from fire related impacts. Some areas remain relatively unaltered and similar to pre-fire conditions, with lush riparian vegetation and complex instream habitat; while other reaches have remnants of scouring, reduction of shallow habitats, and open canopy riffle habitat with minimal riparian vegetation.

No fish were observed by crews conducting dye and flow tests in 2019 and 2020. Trout species, where present, are generally easily observable in pool and run habitats with good water clarity in headwater streams of the White Mountains. While these observations offer little indication of overall population status, visual surveys are generally a reliable indicator of population presence and persistence when multiple size classes are observed. Environmental-DNA surveys conducted in 2017 did detect DNA present from the genus *Oncorhynchus*. Based on the minimal visual observations and high abundances of aquatic macroinvertebrates, it is likely that the fish community remains reduced from fire-related impacts in the mainstem of Bear Wallow creek. All age classes of crayfish were observed throughout in relatively low numbers.



Figure 3. Large log jam depicting some of the more severe post-fire related impacts in the mainstem of Bear Wallow Creek.



Figure 4. Habitat conditions in the mainstem of Bear Wallow Creek that were less affected by fire-related impacts.

Visual Encounter Surveys

June 2019 Results

On 11 and 12 June 2019, and 8–11 June 2020, during pre-treatment streamflow surveys and visual encounter surveys (VES) we did not find any *T. rufipunctatus* (Figures 5,6,7). In 2019 we did detect six *T. elegans*; several more *T. elegans* were observed by additional crews conducting flow tests but were not counted. In 2020 we detected six *T. elegans* and an Arizona Black Rattlesnake (*Crotalus cerberus*). No other riparian amphibians or reptiles were observed. In both survey efforts, warm and sunny summer weather was experienced, with some minimal influence of monsoonal rain patterns. The survey efforts were targeted around the drought period preceding summer monsoon rains when conditions may facilitate more activity for the snakes and concentrate their daily movement patterns closer to the stream channel. Water clarity in Bear Wallow Creek and its tributaries generally remains very clear and conducive to visual surveys for both fish and snakes. The creek generally only increases in turbidity for short durations following severe rainstorms or spring run-off events.

Habitat conditions in 2019 seemed potentially suitable for *T. rufipunctatus* however, no fish were observed in Bear Wallow Creek downstream of the confluence of north and south forks and it is unlikely this stream stretch supports a suitable prey base for *T. rufipunctatus*, except for a couple of isolated portions of the North Fork Bear Wallow. The absence of fish was supported by high abundances of macroinvertebrates and low-hanging spider webs suspended above pool habitats in the lower portions of Bear Wallow Creek. Crayfish were observed throughout the survey locations.

In 2020 we did not observe any fish on the mainstem of Bear Wallow creek but observed numerous crayfish below the fish barrier and a few above. Habitat looked suitable for snakes, but there were no fish observed to serve as a prey base for *T. rufipuncatus*.

2019 Survey Team: Andrew Larson, Bryan Giordano, Veronica Corbett, Noah Carter (intern), Owen Kyle (intern), Ynessa Dominguez (intern).

2020 Survey Team: Jason Myrand (intern), Ryan Clark (intern), Kaleb Smith, Zach Beard, Andrew Larson, Benjamin Cram (USFS), C. Lopez (intern), L. Bobadilla (intern).

2019 Survey Tables

Date	Location	Start Time	End Time	Survey Method	Start UTM E	Start UTM N	End UTM E	End UTM N	Distance (m)
11 June 2019	Bear Wallow Creek	0954	1235	VES	642082	3720270	641371	3721034	1300
11 June 2019	Bear Wallow Creek	1430	1635	VES	639593	3722047	640485	3721917	1080
12 June 2019	Bear Wallow Creek, North Fork	1321	1550	VES	647099	3718100	648061	3717996	1070

Date	Total VES hrs	# THRU VES	# THEL VES
11 June 2019	9	0	6
12 June 2019	5	0	0

Date	Time	Species	VES/Trap	Age Class	UTM E	UTM N
11 June 2019	1038	THEL	VES	Juvenile	641704	3720538
11 June 2019	1042	THEL	VES	Juvenile	641700	3720530

11 June 2019	1106	THEL	VES	Juvenile	641765	3720528
11 June 2019	1505	THEL	VES	Adult	639588	3722080
11 June 2019	1536	THEL	VES	Adult	639633	3722091
11 June 2029	1610	THEL	VES	Adult	640080	3722020

2020 Survey Tables

Date	Location	Start Time	End Time	Survey Method	Start UTM E	Start UTM N	End UTM E	End UTM N	Distance (m)
9 June 2020	Bear Wallow Creek	1023	1708	VES	642612	3720066	641028	3721373	2250
10 June 2020	Bear Wallow Creek, North Fork	1248	1526	VES	646906	3718200	644031	3718694	3100
10 June 2020	Bear Wallow Creek, North Fork	1554	1804	VES	644047	3718718	644945	3718572	947
11 June 2020	Bear Wallow Creek, North Fork	0838	0957	VES	644050	3718723	644997	3718550	1020

Date	Total hrs	# THRU	# THEL	# UROR	# CRCE
9 June 2020	16.72	0	2	3	1
10 June 2020	4.79	0	3	1	0
11 June 2020	1.31	0	1	2	0

Table 3.2 Fish VES observations 2020

Date	Total hrs	# Trout
9 June 2020	16.72	0
10 June 2020	4.79	8
11 June 2020	1.31	2

Date	Time	Species	VES/Trap	Cap Y/N	Sex	Age Class	SVL (mm)	Mass (g)	UTM E	UTM N
9 June 2020	1023	THEL	VES	N	NA	Juvenile	NA	NA	642600	3720038
9 June 2020	1124	CRCE	VES	N	NA	Adult	NA	NA	642507	3720047
9 June 2020	1637	THEL	VES	Y	F	Juvenile	395	19	641210	3721228
10 June 2020	1425	THEL	VES	Y	F	Neonate	195	7	645205	3718517
10 June 2020	1618	THEL	VES	Y	F	Neonate	210	7	644233	3718710
10 June 2020	1638	THEL	VES	Y	M	Juvenile	426	38	644291	3718718
11 June 2020	1045	THEL	VES	N	NA	Juvenile	NA	NA	646000	3718503

Arrival Date & Time: 8 June 2020, 1630h

Leave Date & Time: 11 June 2020, 1235h

Location (general area): Camped at mainstem of Bear Wallow Creek at UTM 640107, 3721973 on 8-9 June 2020. Camped at North Fork confluence with Bear Wallow Creek mainstem at UTM 644031, 3718694 on 10-11 June 2020.

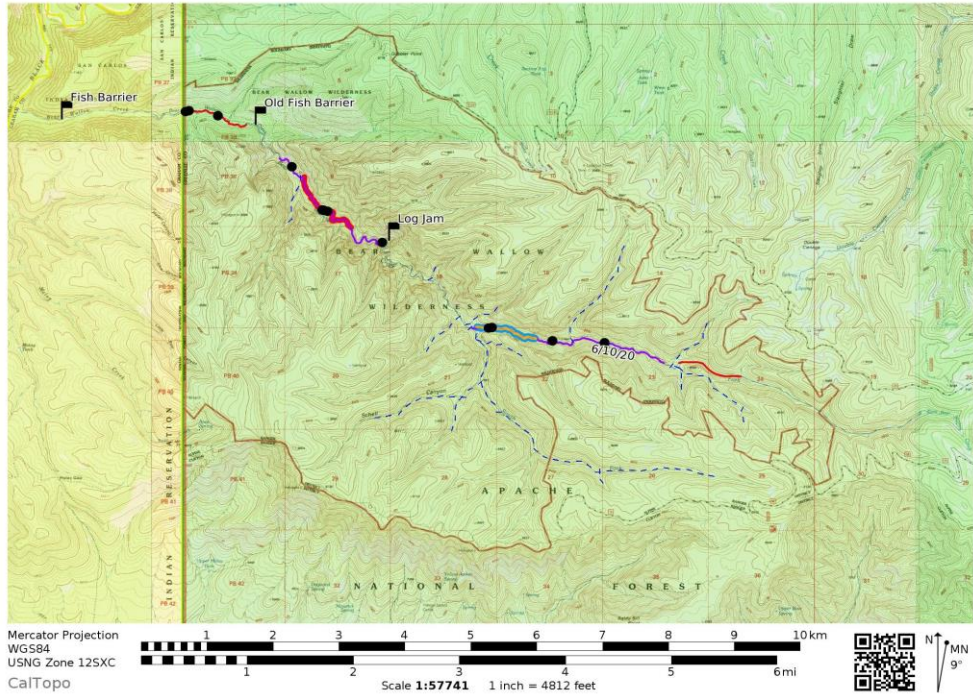


Figure 5. Map depicting Bear Wallow Wilderness. Dotted blue line is anticipated treatment areas. Solid colored lines are locations of VES efforts. Black dots are *T. elegans* observations while conducting VES

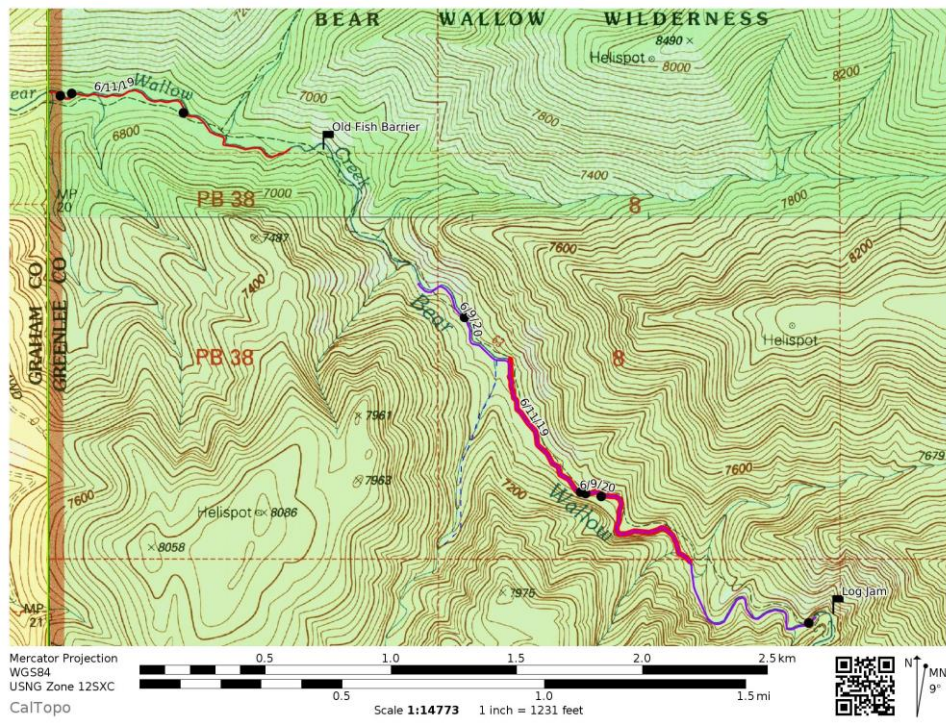


Figure 6. Map of the lower portions of Bear Wallow Creek on the ASNF with colored lines representing individual VES efforts. The black dots indicate *T. elegans* observations while conducting VES

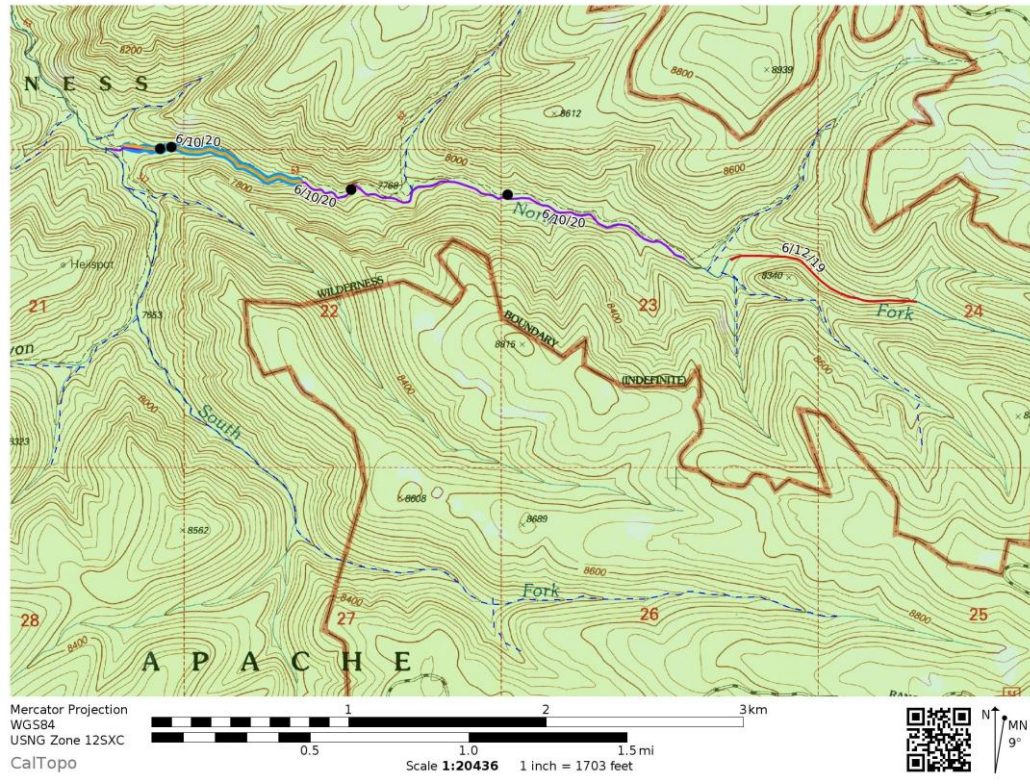


Figure 7. Map of the north and south forks of Bear Wallow Creek. Dotted blue line is the anticipated piscicide treatment area. Solid colored lines represent different VES efforts in 2019 and 2020. Black dots indicated *T. elegans* observations while conducting VES.

Bear Wallow Creek Fish Community Surveys

Prior to the 2011 Wallow Fire, which was believed to have contributing to a severe fish kill in much of Bear Wallow Creek via post-fire impacts, the fish community was understood to be composed of Rainbow Trout x Apache Trout hybrids and some Brown Trout, as supported by surveys in 2008, 2009, and 2010. While two fish passage barriers were present in Bear Wallow, both were deemed ineffective in preventing the upstream movement of Rainbow Trout, which compromised the population of Apache Trout present. Following the Wallow Fire, fish surveys were not conducted in Bear Wallow Creek until 2017, when environmental-DNA samples were collected to determine any remaining presence. Due to the nature of the already compromised recovery population of Apache Trout and ineffective fish passage barriers, surveying the fish community remained a low immediate priority behind other fish populations in the area, resulting in several years of no survey data. The lower-most fish passage barrier on the San Carlos Apache Reservation received several improvements in 2018 including raising the effective height of the barrier, and extending a wall into the adjacent floodplain. It is believed these improvements will isolate the population upstream of this barrier from the fish community below.

2008

A barrier inspection and electrofishing survey was conducted from the upper barrier to a point approximately 1.5 miles upstream, on August 6, 2008. The objective was to check for possible barrier failure and invasion of non-native trout through or over the fish barrier. A log had damaged the gabion

barrier and forced a portion of the gabion off the top layer of the barrier, functionally reducing the height by 1 foot at the spillway. The gabions on the splashpad had been damaged by high flows as well. A total of 9 Apache trout and 22 speckled dace were collected while electrofishing. Three of the Apache trout were young-of-year (~1 inch) and six were between 76 - 350mm total length. Two large non-native brown trout (332 mm and 342 mm total length) were also collected, at 0.9 km and 1.75 km above the upper barrier, documenting failure of the barrier to prohibit movement of nonnative trout upstream into Apache trout habitat. Several of the smaller Apache trout collected just above the barrier appeared to have some rainbow trout characteristics (i.e. pink color on a lateral stripe on the side).

A visual survey was conducted in the upper reaches on August 7, to determine presence of trout in the North Fork of Bear Wallow Creek. Five surveyors worked different sections of the stream from the confluence with the South Fork Bear Wallow upstream to Double Cienega trailhead. A total of 16 adult Apache trout, 77 juveniles, and 34 young-of-year were observed. Numbers of trout were highest near the confluence.

An electrofishing survey was conducted in 2.3 miles of Bear Wallow Creek, to a point approximately 3.3 miles above the upper barrier on August 21-26, to collect fin clips for genetic analysis and to further check for evidence of a barrier failure and invasion of non-native trout through or over the fish barrier. A total of 386 trout were caught (112 adults, 223 juveniles, 51 young of the year, 70 missed), all *Oncorhynchus* species (no additional brown trout were collected). Fin clips were collected from 24 of these trout for genetic analysis, 20 from above the barrier and 4 below the barrier. Four individuals from above the barrier were determined to be hybridized with rainbow trout (Carlson and Culver 2009), indicating that either adult hybrid/rainbow trout had jumped the barrier possibly when the gabion was down and spawned upstream, or hybrid young-of-year had navigated through the interstitial spaces in the barrier to reach upstream habitats. The presence of large brown trout above the barrier is evidence that jumping the barrier was possible for a large rainbow or hybrid trout. Either way, the pure population of Apache trout in Bear Wallow Creek that was reintroduced in 2004 was now compromised.

2009 Electrofishing Surveys

A survey was conducted on June 29-July 2 to determine the population of trout between the lower and upper barriers. Two crews electrofished the entire reach between the barriers, worked in a delayed sequence to complete 2 passes. Crews were approximately a half mile apart for the duration of the survey. All trout caught were removed and placed below the lower barrier. A total of 589 hybrid rainbow-Apache trout were caught between the barriers on the first pass, and 204 were caught on the second pass. A population estimate of 901 fish was calculated by the Zippin (1958) removal method, which leaves 108 fish remaining after the second pass after 793 trout (589+204) were removed and placed below the lower barrier. A population estimate of brown trout over 200 mm between the barriers was also calculated. A total of 13 brown trout were caught on the first pass and 4 on the second pass. A population estimate of 19 fish was calculated, leaving 2 brown trout remaining in the stream after 17 were removed.

2010 Electrofishing Surveys

Hybrid rainbow-Apache trout and brown trout were thought to be jumping the lower fish barrier on the San Carlos Reservation. This section of Bear Wallow Creek between the barriers was never chemically

treated to remove non-native trout, so fish were present before and after the construction of the lower barrier. A survey was designed to detect if new trout were navigating upstream past the lower barrier.

On June 28-29, a two-pass removal electrofishing survey was conducted as a follow-up to a similar survey completed in the summer of 2009. The objective was to search for trout that may have jumped the barrier during the previous monsoon season and spring runoff flows. Two crews electrofished the 2-mile reach between the two barriers. The reach was divided into two sections with each crew completed one section per day. One pass was conducted the first day and another on the second day. Population estimates were calculated as described by Seber and LeCren (1976).

The crews captured 465 hybrid rainbow-Apache trout in the first pass and 157 in the second pass, resulting in a population estimate of 702 hybrid rainbow-Apache trout between the 2 fish barriers. The 702 total captured trout were removed, leaving an estimated 80 hybrid trout remaining after the second pass (Figure 1). The average length of hybrid rainbow-Apache trout was 121 mm total length, and ranged from 80 mm to 270 mm. The estimate of hybrid rainbow-Apache remaining in 2009 was 108 fish.

A population estimate of brown trout was also determined for the June 28-29 survey. The crews captured 166 brown trout in the first pass and 74 in the second pass, resulting in a population estimate of 300 brown trout between the 2 fish barriers. The 240 total captured brown trout were removed, leaving an estimated 60 trout after the second pass (Figure 3). The average length of brown trout was 149 mm total length, and ranged from 94 to 358 mm. Only 2 brown trout were collected that measured over 200 mm.

On September 13-14, another two-pass electrofishing survey was conducted as a follow-up of the survey done in June to search for trout that may have jumped the barrier during the summer monsoon season. Two crews electrofished the 2-mile reach, from the lower barrier to the upper barrier.

A total of 580 hybrid rainbow-Apache trout were caught the first pass and 37 in the second pass. An initial population estimate of 620 fish was determined, which leaves an estimated 31 fish remaining after the second pass (Figure 5).

An estimate of brown trout was also determined for the September 13-14 survey. A total of 85 brown trout were caught the first pass and 4 in the second pass. An initial population estimate of 90 fish was determined, which leaves an estimated 1 brown trout remaining after the second pass (Figure 7). The average length of brown trout was 164 mm and ranged from 84 to 344 mm. There were 7 brown trout collected measuring over 200 mm.

Trout were determined to be jumping the lower fish barrier on Bear Wallow Creek on the San Carlos Indian Reservation based on the large increase in fish numbers between the barriers from June to September.

2017 Environmental-DNA Survey

Following the presumed fish kill in Bear Wallow Creek, caused by severe flooding and ash-flows in the season following the 2011 Wallow Fire, the goal was to determine whether or not a fish population still persisted in Bear Wallow Creek. To determine this, in May of 2017, a Department Crew collected 24 water filter samples to test for environmental DNA presence of any salmonid species. The protocol reflected that outlined in the Environmental DNA collection protocols outlined by the Rocky Mountain Research Station. Samples were collected in various points in the mainstem of Bear Wallow Creek, and a few samples in the downstream ends of the north and south forks. The goal was simply to determine

presence/absence of any salmonid species. The presence of this DNA in Bear Wallow Creek would initiate the need for a piscicide treatment to restore the stream for Apache trout recovery purposes following the improvement of the lower fish passage barrier on the San Carlos Apache Reservation. This was based on the previous data suggesting those Apache trout which were upstream of the barriers pre-Wallow Fire were a hybridized population with Rainbow Trout.

Based on the eDNA results found in the following table and map, Apache Trout x Rainbow Trout hybrids remained only in the North Fork Bear Wallow Creek and in the mainstem of Bear Wallow Creek for a few miles downstream of the confluence of north and south forks. In the lower portion of Bear Wallow to the downstream-most fish passage barrier, no salmonids were detected. No salmonids were detected in the South Fork.

Based on visual habitat observations, it is likely that trout persisted in the North Fork post-fire and were able to begin recolonizing the mainstem of Bear Wallow in the years after. The South Fork Bear Wallow had severe post-fire impacts and likely contributed to a major fish kill throughout the South Fork and downstream of the confluence with the North Fork.

Map ID	Stream	Site	Salmonids detected? ¹	Brown trout detected? ¹	Rainbow trout detected? ¹
1	Bear Wallow Creek	01	0/3	N/A	N/A
2	Bear Wallow Creek	02	0/3	N/A	N/A
3	Bear Wallow Creek*	03	0/3	N/A	N/A
4	Bear Wallow Creek	04	0/3	N/A	N/A
5	Bear Wallow Creek	05	0/3	N/A	N/A
6	Bear Wallow Creek	06	0/3	N/A	N/A
7	Bear Wallow Creek	07	0/3	N/A	N/A
8	Bear Wallow Creek	08	0/3	N/A	N/A
9	Bear Wallow Creek	09	0/3	N/A	N/A
10	Bear Wallow Creek	10	0/3	N/A	N/A
11	Bear Wallow Creek	11	0/3	N/A	N/A
12	Bear Wallow Creek	12	0/3	N/A	N/A
13	Bear Wallow Creek	13	0/3	N/A	N/A
14	Bear Wallow Creek*	14	4/4	0/4	1/4
15	Bear Wallow Creek	15	3/3	0/3	3/3
16	Bear Wallow Creek	16	3/3	0/3	3/3
17	Bear Wallow Creek	17	3/3	0/3	3/3
18	Bear Wallow Creek	18	3/3	0/3	3/3
19	Bear Wallow Creek	19	3/3	0/3	3/3
20	North Fork Bear Wallow Creek	01	3/3	0/3	3/3
21	North Fork Bear Wallow Creek	02	3/3	0/3	3/3
22	North Fork Bear Wallow Creek	03	3/3	0/3	3/3
23	South Fork Bear Wallow Creek	01	0/3	N/A	N/A
24	South Fork Bear Wallow Creek	02	0/3	N/A	N/A

¹Number of runs in each triplicate in which DNA of the target taxa was detected; N/A, not analyzed

*Sample treated to remove PCR inhibitors

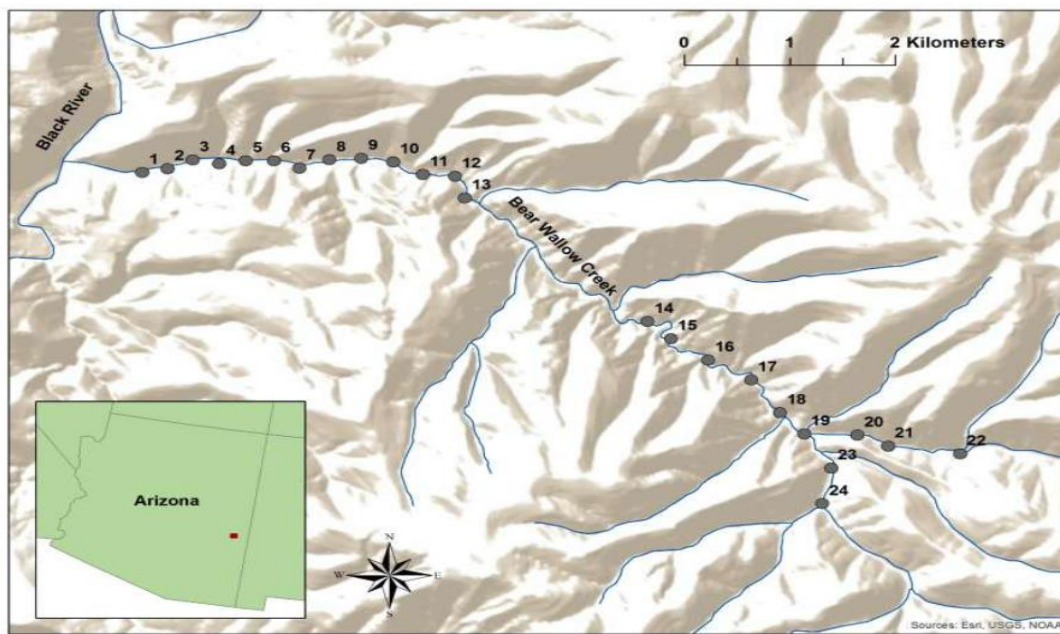


Figure 8. Table displaying eDNA collection sites with associated map. Occupied fish habitat based on this survey data is from points 14 through 22 and likely upstream of that. No fish were detected at points 23 and 24 in the South Fork or downstream of 14. Not that there was no differentiation in testing methods between rainbow trout, Apache trout, or hybrids of the two. (Carim et. al 2018)

2019-2020 Pre-Treatment Planning Surveys

To prepare for a planned piscicide treatment of Bear Wallow Creek intended to restore the native fish community and for the primary purpose of aiding in Apache Trout species recovery purposes, pre-treatment planning trips were conducted in May and June of 2019 and 2020. These surveys consisted of placing fluorescent dye in the water to map flow times across all flowing water in the Bear Wallow drainage. Water velocity measurements were taken in conjunction with these dye flow tests. While no formal fish community surveys occurred during these planning surveys, personnel moved at a very slow pace to follow the course of the dye, which allowed ample time to make any observations of fish. In these surveys, the only trout observed were in the North Fork of Bear Wallow. No fish were observed in the mainstem of Bear Wallow or the South Fork of Bear Wallow. Crayfish were observed everywhere except the South Fork of Bear Wallow. No other native fish species were observed anywhere in Bear Wallow Creek. It appears that the fish community in the North Fork has rebounded to some extent, with trout present in much of the suitable pool and run habitats.

Through these mapping surveys, there were approximately 186 person-hours spent on the ground mapping flow times, measuring velocities, mapping spring locations across, and hiking between locations paralleling the stream. This is in addition to the 36.82 person-hours spent conducting VES specifically for detecting herpetofauna in 2019 and 2020. All persons involved with these trips were instructed of the importance of detecting *T. rufipunctatus* and informed on the identification of this species.

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