

**Gila River Basin Native Fishes Conservation Program:
New Mexico Department of Game and Fish Native Fish Conservation Efforts
2019 Annual Report**



Cooperative Agreement (15AC00046) Between

Bureau of Reclamation

And

New Mexico Department of Game and Fish

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Executive Summary

This report summarizes the Gila River Basin Native Fishes Conservation Program (GRBNFCP) tasks funded for native fish conservation in New Mexico in 2019. Work was conducted under a Cooperative Agreement (15AC00046) between the Bureau of Reclamation (BOR) and the New Mexico Department of Game and Fish (Department). Three ongoing native fish conservation efforts were conducted in 2019: removal of nonnative fishes from the West Fork Gila River, Threatened and Endangered (T&E) fish repatriations and monitoring, and remote site inventory. Two passes were completed for the West Fork Gila River nonnative removal in June 2019. Seven nonnative species were captured and removed. Surveys were conducted to assess the success of repatriation of Loach Minnow *Tiaroga cobitis* in Little Creek and Roundtail Chub *Gila robusta* (previously known as Gila Chub *Gila intermedia*) in Mule Creek. Wild Spikedace *Meda fulgida* were captured from the Gila River and transferred to the Arizona Game and Fish Department (AZGFD) Aquatic Research and Conservation Center (ARCC) to supplement the brood stock. Twenty-six sites in the East Fork Gila River and tributaries were surveyed; seven native and nine nonnative fish species were present at these sites. Specific details of work completed and results for each native fish conservation task are included within this report.

Introduction

The GRBNFCP was established to minimize impacts on threatened and endangered fishes by the Central Arizona Project (CAP). The United States Fish and Wildlife Service (USFWS) biological opinions in 1994, 2001, and 2008 concluded that operation of the CAP required mitigation for the negative effects on federally listed fish species within the entire Gila River Basin. The GRBNFCP is focused on conservation work for five federally listed fishes: Spikedace, Loach Minnow, Gila Chub (now classified as Roundtail Chub), Gila Topminnow *Poeciliopsis occidentalis*, and Razorback Sucker *Xyrauchen texanus*. In the most recent GRBNFCP Strategic Plan (USFWS et al. 2018), the principal goals are described as: 1) achieve enhanced conservation status of federally-listed and candidate fish species in the Gila River basin and; 2) alleviate and diminish threats from nonnative aquatic species that might enter the Gila River basin via the CAP canal or other pathways. The program is funded by the BOR and is directed by the USFWS and BOR in cooperation with the Department and the AZGFD. The Department receives funds from the BOR for work fitting these objectives under Cooperative Agreement 15AC00046. As a requirement of the 2018 amendment to the agreement, the Department prepares an annual report for the GRBNFCP which describes the results of the native fish conservation efforts funded during the preceding calendar year. Most New Mexico native fish conservation tasks are completed through a collaborative effort between the Department, the USFWS, and the United States Forest Service (USFS).

For each task funded in 2019, this report lists the recovery objective(s) the task works toward in the Loach Minnow and Spikedace Recovery Plans (USFWS 1991, 1991) and the Gila Chub and Gila Topminnow Draft Recovery Plans (USFWS 1999, 2015). Work performed by the Department in 2019 is presented under each task. For each task, a background of the work is included followed by results, recommendations for the future, and work planned for 2020.

Removal of Nonnative Fishes from West Fork Gila River (Task NM-2006-1)

Strategic Plan Goals

- Prevent extinction and manage toward recovery
 - Goal 3. Protect native fish populations from nonnative fish invasions.
 - 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.
 - Goal 10. Maintain accurate Program tracking records.

Recovery Objectives

- Loach Minnow Recovery Plan (1991)
 - Task 2.5 (priority 1): Monitor community composition including range of natural variation
 - Task 3.1-2 (priority 2): Identify nature and significance of interaction with nonnative fishes
- Spikedace Recovery Plan (1991)
 - Task 2.5 (priority 1): Monitor community composition including range of natural variation
 - Task 3.1-2 (priority 2): Identify nature and significance of interaction with nonnative fishes

Background

The West Fork Gila River supports an intact native fish assemblage including federally endangered Spikedace and Loach Minnow as well as state endangered Roundtail Chub (previously known as Headwater Chub *Gila nigra*). In addition, federally threatened Gila Trout *Oncorhynchus gilae* are stocked in cooler months to provide a recreational fishing opportunity and support Gila Trout recovery efforts. Ten species of nonnative fishes have been documented in the river including Yellow Bullhead *Ameiurus natalis*, Smallmouth Bass *Micropterus dolomieu*, Rainbow Trout *Oncorhynchus mykiss*, and Brown Trout *Salmo trutta*. The Department and partners have been removing nonnative fishes from an approximately 4 km reach of the West Fork Gila River at the Department-owned Heartbar Wildlife Management Area since 2006. This reach lies in the vicinity of the confluence of the Middle and West Forks of the Gila River, an area also commonly referred to as “The Forks” (Figure 1). Nonnatives are removed from the Little Creek confluence upstream to the NM15 Bridge. The removal effort consists of a single pass of sampling by individual habitat. Pools and runs are electrofished with two shockers simultaneously, riffles are electrofished and kicknetted into a seine, and sandy shoals are seined. Fish and habitat data collected during this removal effort included species, effort, habitat type, and area sampled. Length and weight data are collected for the first 50 individuals of each species captured each day; after 50 lengths and weights have been recorded the remaining fish are enumerated by species. The same stretch of river is sampled annually; the river has changed considerably since the project began in 2006, including a major shift of the river channel and high variability in the number of braided channels encountered year to year. Propst et al. (2014) evaluated this effort using data from 2007 to 2012. Results suggested that with this removal effort it is possible to reduce biomass of some nonnative

species and increase Spikedace biomass (Propst et al. 2014). With this documented reduction of nonnative species, the GRBNFCP decided to continue the effort. The removal requires a crew of 6 to 9 people and takes 4 to 5 days to complete; it is conducted annually in June.

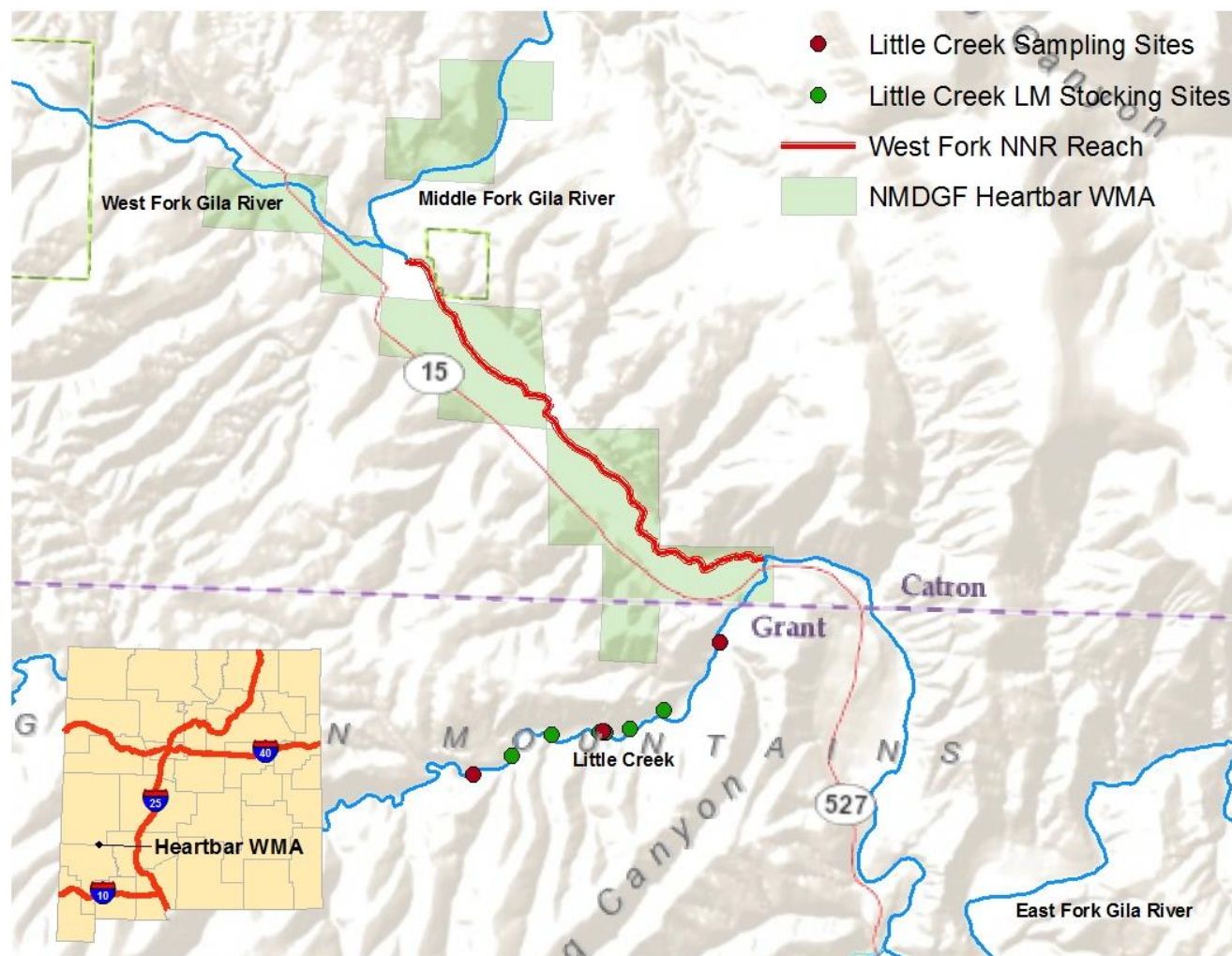


Figure 1. Map showing the location of the West Fork Gila River nonnative fish removal and Little Creek with locations of 2019 surveys and all Loach Minnow (LM) stocking sites.

Results

Department, USFWS, and USFS staff conducted the West Fork Gila River nonnative removal from June 10 to June 13, 2019. The effort consisted of 50,922 seconds of shocking on the first pass. A second pass consisting of 30,255 seconds of electrofishing was conducted because the first pass was completed in 3 days; the second pass targeted only nonnatives. Numbers and densities of fish captured on the first pass in 2019, excluding unidentifiable *Catostomids* (<30mm), are shown in Table 1. Nonnative fishes removed on the second pass are shown in Table 2. Sonora Sucker *Catostomus insignis*, Longfin Dace *Agosia chrysogaster*, and Desert Sucker *Catostomus clarkii* were the most abundant native species (Figure 1). Yellow Bullhead remained the most abundant nonnative species and Brown Trout (n=9) were found in

the removal reach for the first time since 2012. (Figure 2). Young of the year fish were less abundant in 2019 than in 2018, likely due to the timing of the survey (Appendix A). Gravid Yellow Bullhead females were documented during the removal. Run habitat was the most commonly sampled habitat throughout the removal reach (Table 3).

Table 1. Total number of individuals captured and density of all fishes in the West Fork Gila River nonnative removal in 2019.

	Species	Number Captured	Density (fish/100m ²)
Native			
	Desert Sucker	391	1.45
	Loach Minnow	413	1.53
	Longfin Dace	523	1.93
	Roundtail Chub	5	0.02
	Sonora Sucker	792	2.93
	Speckled Dace	104	0.38
	Spikedace	47	0.17
Nonnative			
	Brown Trout	9	0.03
	Common Carp	17	0.06
	Fathead Minnow	3	0.01
	Red Shiner	2	0.01
	Smallmouth Bass	12	0.04
	Western Mosquitofish	46	0.17
	Yellow Bullhead	240	0.89

Table 2. Total number of nonnative fish removed during second pass and electrofishing catch per unit effort (CPUE).

Species	Number Captured	CPUE (fish/hr)
Brown Trout	3	0.36
Common Carp	3	0.36
Red Shiner	1	0.12
Smallmouth Bass	5	0.59
Western Mosquitofish	19	2.26
Yellow Bullhead	82	9.76

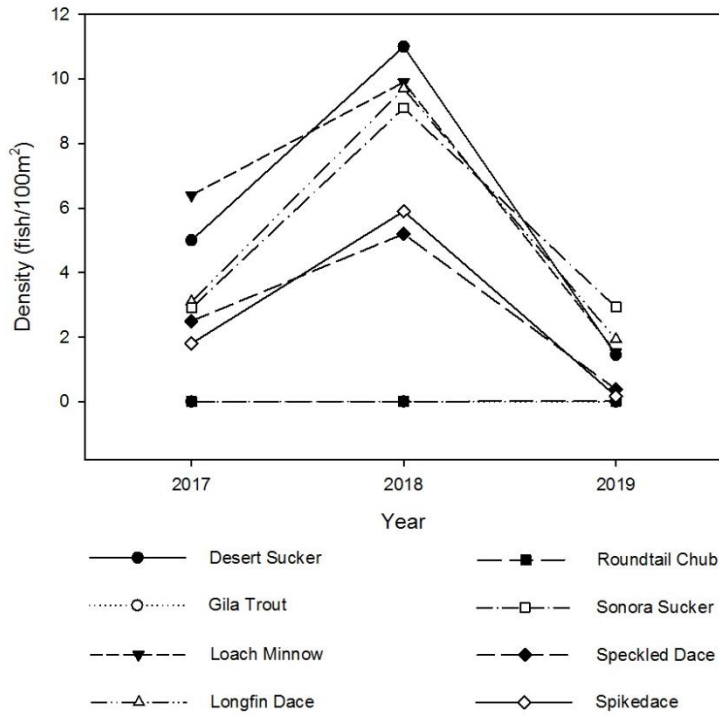


Figure 1. Overall density of native fish species captured in the West Fork Gila River nonnative removal from 2017 to 2019.

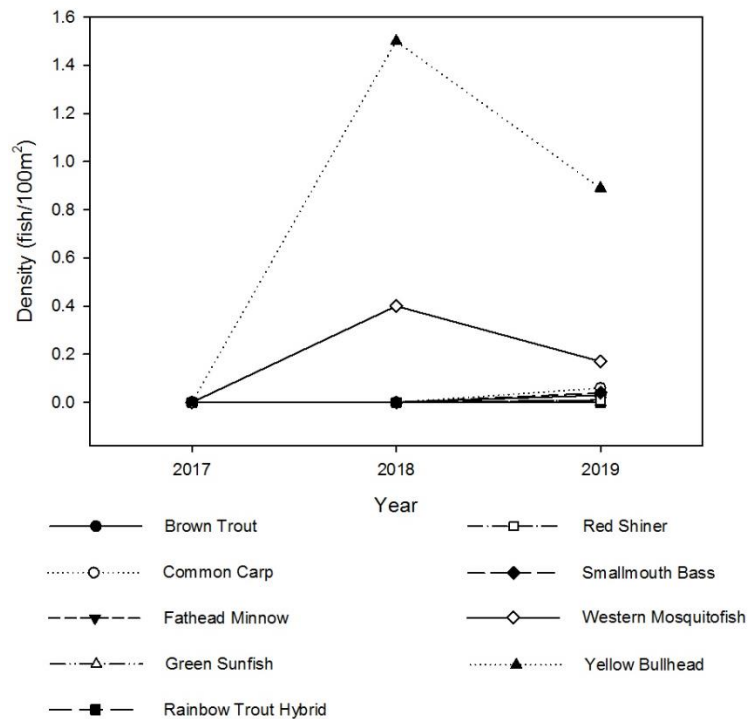


Figure 2. Overall density of nonnative fish species captured in the West Fork Gila River nonnative removal from 2017 to 2019.

Table 3. Area sampled (m²), percent composition, mean depth (m) ± SE, and mean velocity (m/s) ± SE of all habitat types sampled on the first pass of the West Fork Gila nonnative removal in 2019.

Habitat Type	Area Sampled	Percent Composition	Mean Depth	Mean Velocity
Backwater	222	0.8	0.23±0.06	0.02±0.01
Isolated Pool	100	0.4	0.30	0.00
Pool	2135	7.9	0.68±0.06	0.18±0.03
Riffle	2621	9.7	0.19±0.01	0.53±0.02
Run	21962	81.2	0.41±0.02	0.24±0.02

Recommendations

- In order to reduce nonnatives and potentially benefit the native fishes with nonnative suppression, we recommend continuing nonnative removal efforts on the West Fork Gila River.

Work Planned for 2020

- Conduct West Fork Gila River nonnative removal on 4 km Heartbar Wildlife Management Area reach in June 2020.

New Mexico T&E Fish Repatriations and Monitoring (Task NM-2002-1)

Strategic Plan Goals:

- Prevent extinction and manage toward recovery
 - Goal 1. Identify critical streams and populations in need of protection and potential replication.
 - Goal 2. Maintain and operate ASU topminnow holding facility and the Aquatic Research and Conservation Center (ARCC) to support the Program's recovery efforts for imperiled fishes in the Gila River Basin through the establishment of refuge populations of genetically distinctive stocks as insurance against extinction in the wild, captive propagation for repatriation, and applied research.
 - Goal 5. Replicate populations and their associated native fish community into protected streams and other surface waters.
 - Goal 9. Monitor to quantitatively measure and evaluate project success in improving the status of species and their habitats.
 - Goal 10. Maintain accurate Program tracking records.

Recovery Objectives

- Gila Chub Recovery Plan (2015 Draft)
 - Task 3 (priority 2): Monitor remnant and replicated populations to ensure they are persisting and threats are being managed
- Gila Topminnow Recovery Plan (1999 Draft)
 - Task 2.1 (priority 1): Identify suitable habitats
 - Task 2.2 (priority 1): Reestablish into suitable habitats

- Task 3.1 (priority 1): Develop standardized population and habitat monitoring protocols and implement them
- Loach Minnow Recovery Plan (1991)
 - Task 6.2 (priority 3): Identify and prepare sites for reintroduction
 - Task 6.3-4 (priority 3): Reintroduce into selected reaches and monitor
 - Task 6.5-6 (priority 3): Determine reasons for success/failure and rectify as necessary
 - Task 8.2 (priority 3): Collect hatchery stocks
- Spikedace Recovery Plan (1991)
 - Task 6.2 (priority 3): Identify and prepare sites for reintroduction
 - Task 6.3-4 (priority 3): Reintroduce into selected reaches and monitor
 - Task 6.5-6 (priority 3): Determine reasons for success/failure and rectify as necessary
 - Task 8.2 (priority 3): Collect hatchery stocks

Background

This task is used to identify potential repatriation streams, evaluate potential donor populations and repatriation sites, conduct repatriation to identified streams, monitor streams post-repatriation, and supplement hatchery populations as needed. Repatriations consist of multiple stockings into each repatriation stream successively for 3 to 5 years or until monitoring of the repatriated streams determines the populations are established or considered unsustainable. Established streams are then surveyed at least once every five years. It is an ongoing effort to find and evaluate new waters where repatriation may be possible. This task encompasses all New Mexico streams within the Gila River basin that might undergo repatriation attempts. Repatriation stockings can be direct transfers of fish from a wild population or stocking from a hatchery such as ARCC. This task is also used for collecting live fish for the purposes of direct stocking, quarantine at ARCC, or development and maintenance of brood stock at ARCC.

Results

Several ongoing repatriation projects were continued in 2019, including post-repatriation surveys and stockings. On June 3 and June 4, 2019, Spikedace (n=79) were collected from the Gila River at the Gila River Bird Area and transferred to ARCC for maintenance of the Gila Mainstem broodstock at the captive facility.

Stocking and Surveys

Bear Creek

A Department biologist assisted Marsh and Associates with a survey of Bear Creek as part of the GRBNFCP monitoring contract on June 24, 2019. Desert Sucker (n=46), Loach Minnow (n=83), Longfin Dace (n=303), and Western Mosquitofish *Gambusia affinis* (n=1) were captured. An additional survey site was attempted upstream but private land and impassable roads restricted access to the upper reaches of Bear Creek. Survey details will be included in the Marsh and Associates monitoring contract report.

Citizen Canyon

Department and AZGFD staff surveyed Citizen Canyon on May 2, 2019. Citizen Canyon is a tributary to the San Francisco River that crosses the New Mexico/Arizona state line (Figure 3). It is remote and previous survey data is limited so it was assessed as a potential repatriation stream for Loach Minnow and/or Roundtail Chub. Approximately 100 m of stream was electrofished and Longfin Dace (n=35) and Speckled Dace (n=92) were captured in 1,037 s of electrofishing. Marginal habitat may exist for Loach Minnow and/or Roundtail Chub in the survey reach. Pool habitat was limited, but several shallow pools existed. Another survey would need to be completed at low water conditions to determine the amount of habitat available during drought conditions.

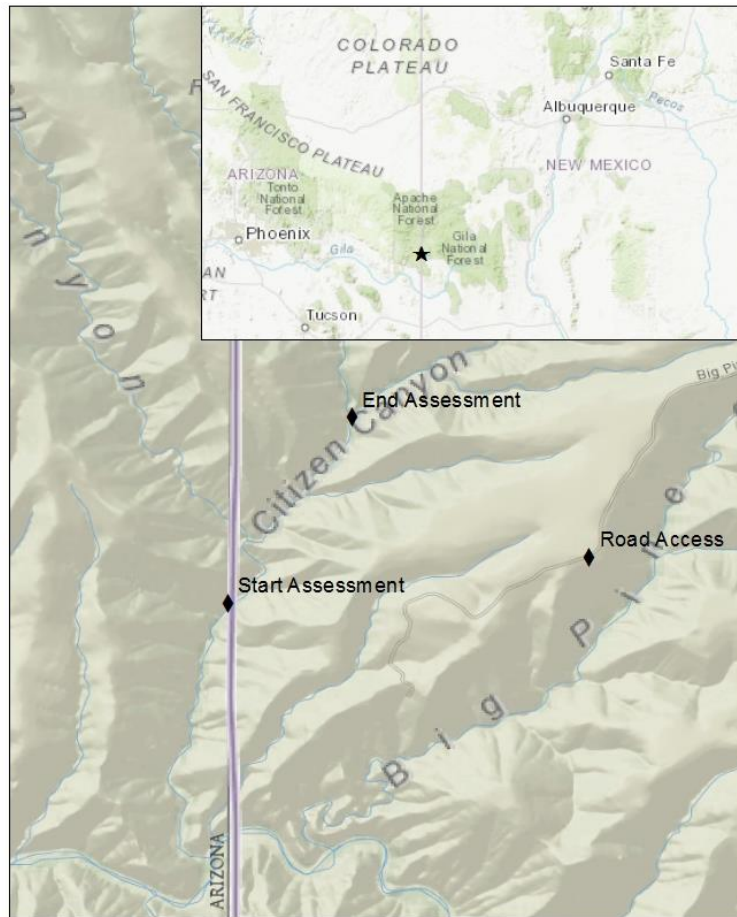


Figure 3. Map of Citizen Canyon displaying area that was assessed and access road that was used.

Mule Creek

Mule Creek was stocked with 299 Roundtail Chub (previously Gila Chub) from Harden Cienega Creek in Arizona from 2012 to 2014. Smallmouth Bass, Black Bullhead *Ameiurus melas*, and Green Sunfish *Lepomis cyanellus* were found within the repatriation area in February 2016, and stocking efforts were suspended to assess their effect (NMDGF 2016). Mule Creek was surveyed using single pass electrofishing on July 25, 2019 by Department and USFWS staff to assess the repatriated Roundtail Chub

population. The sampled reaches were upstream of 2018 survey locations, but still within the stocking area (Figure 4). Three large minnow traps were also set in side pools and one deep pour over pool where electrofishing was not effective. Forty-four Roundtail Chub were captured during electrofishing (47.1 fish/hour) and evidence of natural reproduction was found with 27 fish under 110 mm total length (Figure 5). Other native fish species captured in Mule Creek include Longfin Dace, Desert Sucker, Sonora Sucker, and Speckled Dace (Table 4). Minnow traps captured native fish, including Roundtail Chub, as well as nonnative Black Bullhead and Green Sunfish (Table 5). Two of the three traps captured nonnative fish and both of those traps were located in different areas of unique backwater habitat (Figure 6). The 2019 survey indicates low numbers of nonnatives occupying very limited habitat and Roundtail Chub reproduction.

Table 4. Total number of fish captured by electrofishing and electrofishing catch per unit effort (CPUE) in Mule Creek.

Species	Number Caught	CPUE (fish/hour)
Desert Sucker	272	291.1
Longfin Dace	40	42.8
Roundtail Chub	44	47.0
Sonora Sucker	156	166.9
Speckled Dace	39	41.7

Table 5. Total number of fish captured by minnow traps and mean catch per unit effort (CPUE) of minnow traps in Mule Creek.

Species	Number Caught	CPUE (mean fish/hour± SE)
Black Bullhead	2	5.8±5.8
Desert Sucker	1	3.9±3.9
Green Sunfish	4	12.2±8.3
Roundtail Chub	3	8.7±8.7
Sonora Sucker	13	40.6±25.2



Figure 4. Map of 2018 and 2019 Mule Creek sampling reaches and 2013 and 2014 Roundtail Chub (previously Gila Chub) stocking locations.

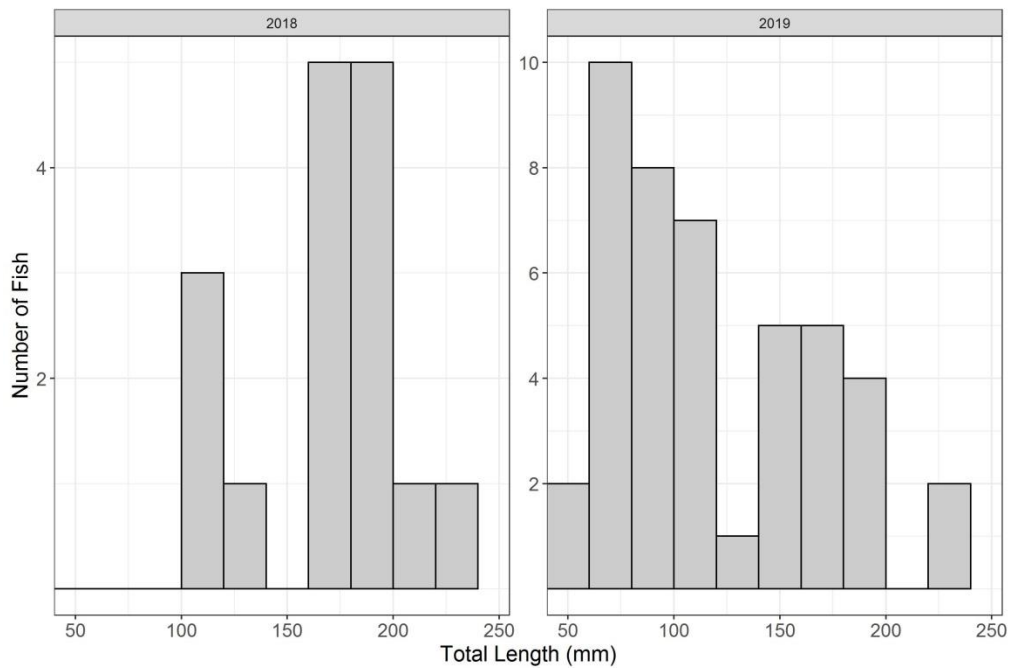


Figure 5. Length frequency histogram of Roundtail Chub captured in Mule Creek in 2018 and 2019. Bin width is 20mm.



Figure 6. Photo of unique habitat where nonnative fish were captured. Traps were placed in this pool and on the other side of the boulder in similar pool habitat. No other habitats like this were documented.

Little Creek

Little Creek has been stocked with Loach Minnow for five consecutive years from 2014 to 2018 (Table 6). On June 2, 2019, Department staff surveyed Little Creek to evaluate Loach Minnow repatriation. Three sites were sampled near the stocking locations (Figure 1). Suitable Loach Minnow habitat was targeted during the survey and each location was sampled by shocking into a seine. Although over 1,000 Loach Minnow were stocked in 2018, no Loach Minnow were captured in 2019. Other species captured included Speckled Dace, Longfin Dace, Desert Sucker, Sonora Sucker, and Brown Trout (Table 7). Brown Trout were captured lower than in previous years, within the Loach Minnow stocking area. The number of Loach Minnow captured has been declining since 2017 and there has been no evidence of natural reproduction (Table 8).

Table 6. Loach Minnow stocked into Little Creek, 2014-2018. For fish stocked from ARCC, lineage is displayed within parentheses.

Date	Number Stocked	Stocking Source
November 18, 2014	267	ARCC (Gila Forks)
September 3, 2015	62	WF Gila River
November 15, 2016	125	WF Gila River
November 30, 2017	159	ARCC (Gila Forks)
November 30, 2017	103	WF Gila River
December 10, 2018	1,187	ARCC (Gila Forks)

Table 7. Total number of fishes captured and catch per unit effort (CPUE) of all fishes sampled in Little Creek in 2019.

Species	Number Captured	CPUE (fish/hour)
Brown Trout	8	6.3
Desert Sucker	21	16.6
Longfin Dace	3	2.3
Sonora Sucker	2	1.5
Speckled Dace	67	53.0

Table 8. Loach Minnow captured in post repatriation surveys.

Date	Loach Minnow Captured	CPUE (fish/hour)
2017	45	35.1
2018	3	3.8
2019	0	0

Saliz Canyon

After two years of Loach Minnow stocking, stocking was postponed in 2018 due to habitat degradation resulting from the Owl Fire. In June 2019, Department and USFWS staff visually assessed the stocking reach of Saliz Canyon. Suitable habitat was found, the substrate was less embedded than in 2018, and other fish species appeared to have recovered. Three-hundred-and five Loach Minnow were stocked from ARCC into Saliz Canyon on June 3, 2019.

San Francisco

Spikedace have been stocked into the San Francisco River five times since 2008 (Ferguson and Ruhl 2018). Spikedace were first found at the annual monitoring site in 2017 and were captured again in 2019. The monitoring site is approximately 20 miles from the location where Spikedace were stocked. Loach Minnow were stocked in 2014 near Glenwood for post-fire repatriation (NMDGF 2016). Since that stocking, Loach Minnow have reestablished in the Glenwood area with consistent catches during annual monitoring. Populations of both Loach Minnow and Spikedace are persisting in the San Francisco. Populations will continue to be monitored, primarily through the annual monitoring site, and future stocking will be conducted as needed.

Recommendations

- With the increase in Loach Minnow numbers on the Department’s Bear Creek property, distribution of Loach Minnow in Bear Creek should be further investigated.
- Roundtail Chub are persisting in Mule Creek despite low numbers of nonnative fish. Successful recruitment has been documented and Roundtail Chub have been captured throughout a 2.5-mile survey reach. Mule Creek should be sampled again in 3 to 5 years (by 2024) to assess the Roundtail Chub population and monitor nonnative fish populations.
- Loach Minnow have been stocked in Little Creek for five years, however none were captured during the last survey. We recommend ending stocking and continuing monitoring of Little Creek in 2020.

- Saliz Creek should be stocked with Loach Minnow in 2020. It is likely effects of the Owl Fire have reset the stocking efforts and therefore Saliz stocking efforts may need to continue until 2025.
- Further investigate Citizen Canyon during a dry period to assess habitat suitability for Loach Minnow and/or Roundtail Chub.

Work Planned for 2020

- Stock Loach Minnow into Saliz Canyon.
- Conduct surveys of repatriated Loach Minnow population in Little Creek.
- Transfer Loach Minnow and/or Spikedace to ARCC to supplement hatchery populations if source populations are stable.

Remote Site Inventory and Assessment (Task NM-2017-1)

Strategic Plan Goals:

- Prevent extinction and manage toward recovery
 - Goal 1. Identify critical streams and populations in need of protection and potential replication.
 - Goal 9. Monitor to quantitatively measure and evaluate project success in improving the status of target species and their habitats.
 - Goal 10. Maintain accurate Program tracking records.

Recovery Objectives

- Loach Minnow Recovery Plan (1991)
 - Task 1.1 (priority 1): Identify all populations and determine level of protection
 - Task 2.5 (priority 1): Monitor community composition including range of natural variation
 - Task 3.1-2 (priority 2): Identify nature and significance of interaction with nonnative fishes
 - Task 6.2 (priority 3): Identify and prepare sites for reintroduction
- Spikedace Recovery Plan (1991)
 - Task 1.1 (priority 1): Identify all populations and determine level of protection
 - Task 2.5 (priority 1): Monitor community composition including range of natural variation
 - Task 3.1-2 (priority 2): Identify nature and significance of interaction with nonnative fishes
 - Task 6.2 (priority 3): Identify and prepare sites for reintroduction

Background

Potential habitat for Loach Minnow, Spikedace, Desert Sucker, Sonora Sucker, Speckled Dace, Longfin Dace, and Gila Trout occur in the East Fork Gila River and its tributaries. At the Department's East Fork Gila annual fall monitoring site, Loach Minnow have not been captured since 1998 and Spikedace have not been captured since 2000. Survey data from the East Fork Gila drainage outside of the fall monitoring site is limited due to access. A thorough assessment has not been conducted since the GRBNFCP funded an inventory of each of the Gila River forks from 2005-2008 (Paroz et al. 2009). Our

goal was to repeat the previous sites surveyed, as well as sample additional sites throughout the East Fork Gila River and its tributaries. The Department has little or no previous survey history for the additional sites. Taylor Creek and Beaver Creek have records of Spikedace and Roundtail Chub from the 1930s. In the East Fork Gila River an undescribed species of catfish called Chihuahua Catfish *Ictalurus sp.* are believed to be present, although Channel Catfish *Ictalurus punctatus* and Flathead Catfish *Pylodictis olivaris* have also been documented. With this ongoing uncertainty, catfish captured in the East Fork Gila survey are reported as *Ictalurus sp.* Tissues were collected from all *Ictalurus sp.* captured for future genetic analysis.

Results

Department, USFWS, and USFS staff surveyed the East Fork Gila River from May 6 to May 10, 2019. A total of 26 sites were surveyed on the East Fork Gila River, Black Canyon, and Apache Creek. Five sites were at or near previously established survey sites and 21 sites filled in gaps at new locations (Figure 7). Staff split into two crews with the upper crew covering sites 4 to 6 on the East Fork. The lower crew sampled sites 2 through 3 on the East Fork, site 0 to 3 on Black Canyon and a site on Apache Creek. The following week (May 13 to May 17), Department and USFWS staff surveyed sites on the East Fork Gila River from site 8 to site 12 as well as two sites on Beaver Creek and two sites on Taylor Creek. Department staff finished East Fork surveys from July 1 to 3 with site East Fork Gila site 1A and 7A and three sites on Diamond Creek. Sites were sampled by habitat using a backpack electrofisher and seine following the same sampling methods as the previous survey in 2008 (Paroz et al. 2009). A high proportion of nonnatives were captured in the East Fork Gila River (43.9%), Taylor Creek (79.4%), and Beaver Creek (98.0%), but a lower proportion was found in Black Canyon (2.7%), and no nonnatives were found in Diamond Creek (Table 9).

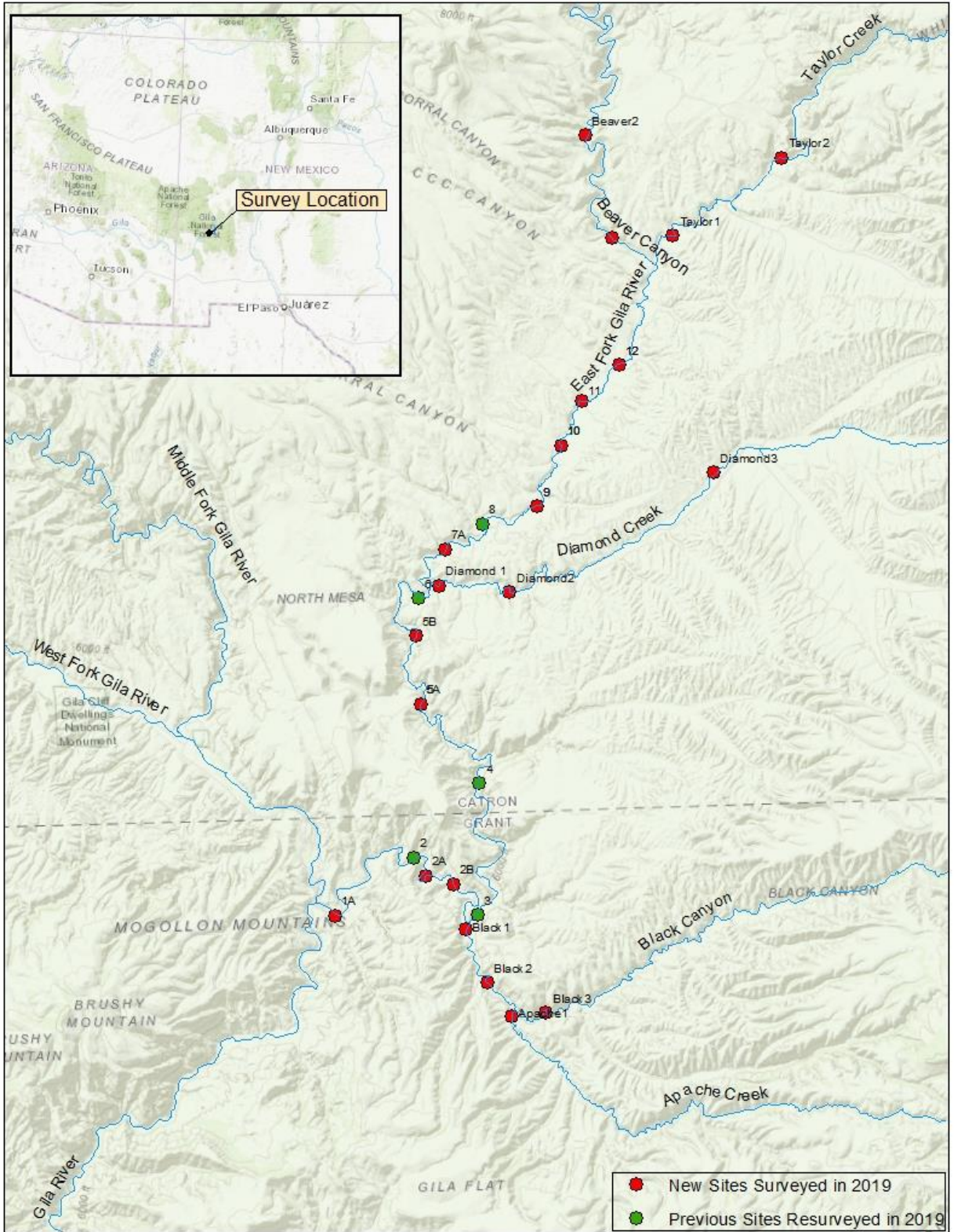


Figure 7. Map of East Fork Gila River and tributaries showing location of sites sampled in 2019.

Table 9. Total number of individuals captured and density (fish/100m²) of all fishes by site in the East Fork Gila River drainage surveys in 2019. Sites with asterisks indicate new sampling locations.

Site	Desert Sucker		Gila Trout		Loach Minnow		Longfin Dace		Roundtail Chub		Sonora Sucker		Speckled Dace		Black Bullhead		Brown Trout		Ictalurus sp.		Green Sunfish		Largemouth Bass		Rainbow Trout/Hybrid		Smallmouth Bass		Western Mosquitofish		Yellow Bullhead	
	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density
1A*	33	12.5	0	0	4	1.5	0	0	0	0	14	5.3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1.1	0	0	3	1.1	
2	23	1.8	0	0	0	0	0	0	0	0	27	2.1	0	0	1	0.1	0	0	0	1	0.1	0	0	0	0	4	0.3	0	0	0	0	
2A*	17	0.9	0	0	0	0	0	0	0	0	16	0.9	0	0	0	0	0	0	0	0	0	0	0	1	0.1	9	0.5	0	0	0	0	
2B*	23	1.6	0	0	0	0	0	0	0	0	38	2.7	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.3	360	25.3	0	0	
3	15	1.4	0	0	0	0	0	0	0	0	18	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3	0	0	4	0.4	
4	35	7.9	0	0	0	0	0	0	0	0	30	6.8	0	0	0	0	0	1	0.2	0	0	0	0	0	11	2.5	0	0	1	0.2		
5	16	2.8	0	0	0	0	0	0	0	0	29	5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2	1	0.2	0	0	
5A*	39	9	0	0	0	0	0	0	0	0	30	6.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.5	
5B*	14	4.6	0	0	0	0	0	0	0	0	17	5.6	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1.6	0	0	5	1.6	
6	22	4.9	0	0	0	0	0	0	0	0	23	5.1	0	0	0	0	0	1	0.2	0	0	0	0	0	0	3	0.7	0	0	1	0.2	
7A*	0	0	0	0	0	0	0	0	0	0	12	5.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.7	
8	1	0.2	0	0	0	0	0	0	0	0	13	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2	0	0	5	1.9	
9*	20	7.5	0	0	0	0	0	0	0	0	12	4.5	0	0	0	0	0	3	1.1	0	0	0	0	0	0	0	0	0	0	5	1.9	
10*	5	1.1	0	0	0	0	0	0	0	0	11	2.5	0	0	0	0	0	2	0.5	0	0	0	0	0	0	1	0.2	0	0	4	0.9	
11*	0	0	0	0	0	0	0	0	0	0	2	0.4	0	0	0	0	0	0	0	3	0.7	0	0	0	0	0	0	0	0	0	0	
12*	1	0.2	0	0	0	0	0	0	0	0	7	1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Apache1*	0	0	0	0	0	0	0	0	0	0	0	0	33	14.4	0	0	1	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	
Beaver1*	1	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	5.8	0	0	0	0	2	0.7	2	0.7	6	2.2		
Beaver2*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	7.3	0	0	0	0	2	1.1	4	2.3	5	2.8	
Black1*	30	3.5	0	0	0	36	4.2	1	0.1	6	0.7	55	6.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Black2*	23	2.6	1	0.1	0	3	0.3	0	0	16	1.8	39	4.4	0	0	0	0	0	0	0	0	0	0	1	0.1	0	0	0	0	0	0	
Black3*	32	3.9	2	0.2	0	3	0.4	0	0	14	1.7	102	12.5	0	0	3	0.4	0	0	0	0	0	0	6	0.7	0	0	0	0	0	0	
Diamond1*	2	0.9	0	0	0	6	2.8	0	0	25	11.9	7	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Diamond2*	13	6.4	0	0	0	0	0	0	0	31	15.2	23	11.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Diamond3*	11	4.9	0	0	0	56	24.7	0	0	12	5.3	19	8.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Taylor1*	9	6.9	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.6	4	0.8	33	6.9	
Taylor2*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.9		

East Fork Gila River

Desert Sucker, Black Bullhead, *Ictalurus* sp., Green Sunfish, and Smallmouth Bass occupied more of the established sites than in 2005 and 2007 sampling (Table 10). Black Bullhead and *Ictalurus* sp. were not captured in 2005 and 2007 surveys but were captured in 2019 surveys. Flathead Catfish and Brown Trout were captured in the previous surveys but not in the 2019 surveys. As in the previous surveys, the only small bodied fish captured were Western Mosquitofish and the fish community consisted of mostly nonnative fish (Table 11). Presence of *Ictalurus* sp. increased further upstream in the East Fork Gila River (Figure 8). Loach Minnow were only found at the lowest site during the survey, near the Gila River confluence (Figure 9). Loach Minnow are known to persist in the lower East Fork Gila River and in the Gila River at the East Fork Gila River confluence. Above this site is private property, it is unknown how far up the East Fork Gila River Loach Minnow persist. The next site surveyed upstream was approximately 8 miles from this location, the East Fork Gila River annual monitoring site is located approximately 21 miles upstream.

Table 10. Fish species captured at sites that were repeated from previous East Fork Gila survey. X indicates that the species was present.

Site	Desert Sucker		Roundtail Chub		Sonora Sucker		Black Bullhead		<i>Ictalurus</i> sp.		Flathead Catfish		Green Sunfish		Rainbow Trout/Hybrid		Smallmouth Bass		Western Mosquitofish		Yellow Bullhead	
	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019	2005/2007	2019
2		X			X	X		X			X			X			X	X			X	
3	X	X			X	X											X	X	X			X
4	X	X			X	X				X								X			X	X
5	X	X	X		X	X									X		X	X		X	X	
8	X	X			X	X											X	X			X	X

Table 11. Mean density by species (fish/100m² ± SE) and percent composition for 16 sites sampled at the East Fork Gila River in 2019.

Species	Density	Percent Composition
Native		
Desert Sucker	3.53 ± 0.96	26.1
Loach Minnow	0.09 ± 0.09	0.4
Sonora Sucker	3.67 ± 0.53	29.0
Nonnative		
Black Bullhead	0.01 ± 0.01	0.1
Catfish spp.	0.17 ± 0.08	0.9
Green Sunfish	0.01 ± 0.01	0.2
Rainbow Trout/Hybrid	0.01 ± 0.01	0.1
Smallmouth Bass	0.49 ± 0.17	4.4
Yellow Bullhead	0.59 ± 0.17	3.1
Western Mosquitofish	1.59 ± 1.58	35.7

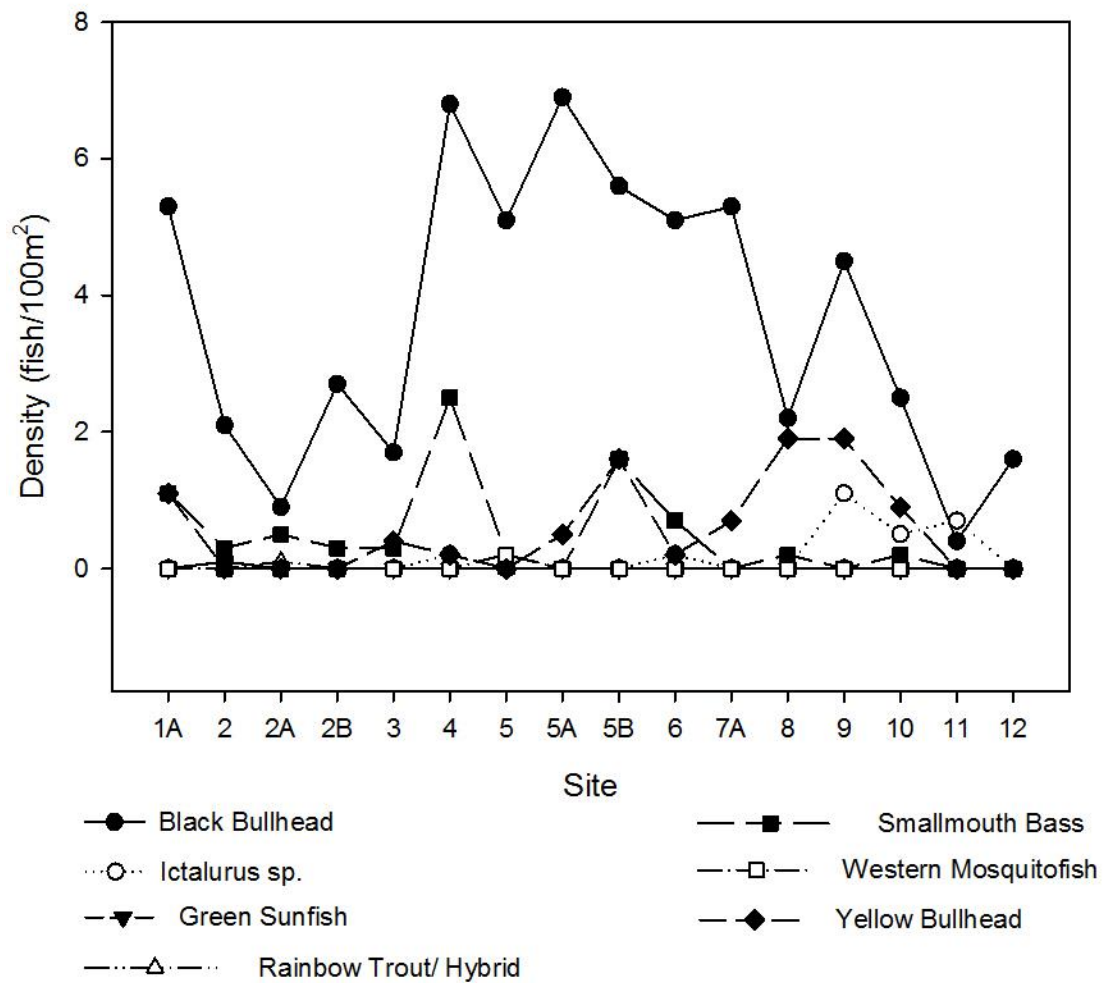


Figure 8. Density of nonnative fish captured in the East Fork Gila moving upstream from the confluence of the Gila River (left to right). Western Mosquitofish density at site 2B is excluded to improve figure clarity.

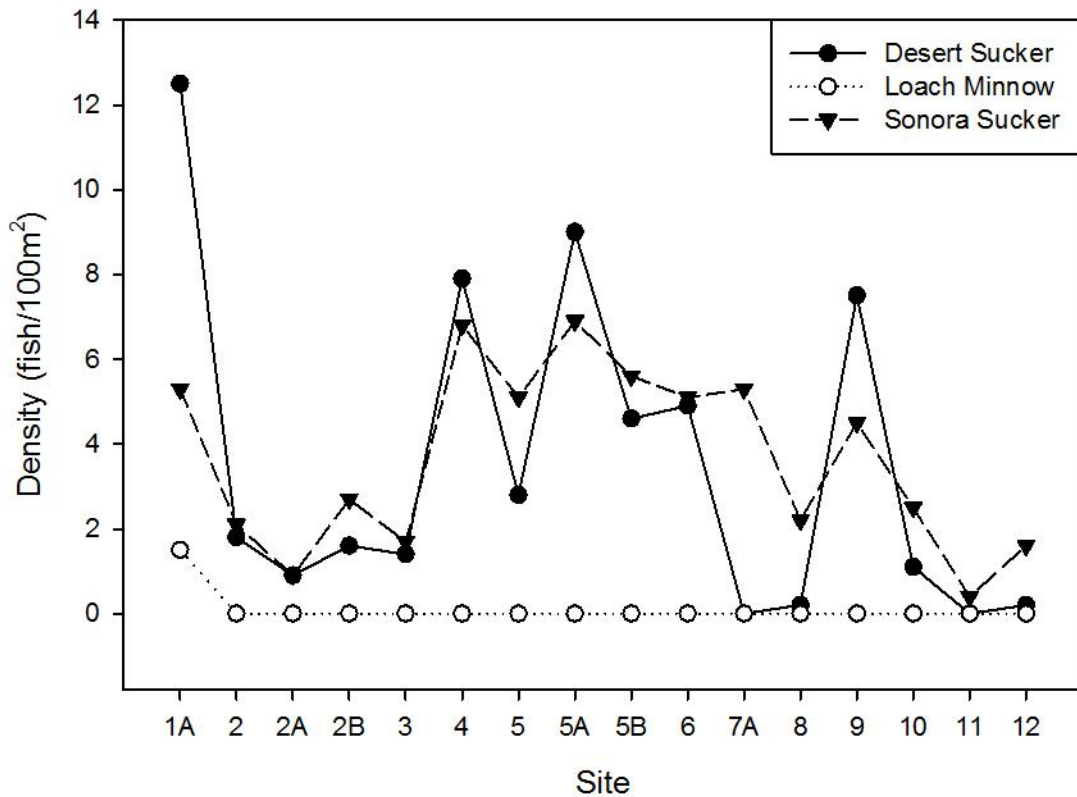


Figure 9. Density of native fish captured in the East Fork Gila moving upstream from the confluence of the Gila River (left to right).

Beaver Creek

The only native fish captured in Beaver Creek was Desert Sucker (Table 12). *Ictalurus* sp. was the most abundant species at the two sites sampled.

Table 12. Mean density by species (fish/100m² ± SE) for 2 sites sampled at Beaver Creek in 2019.

Species	Density	Percent Composition
Native		
Desert Sucker	0.20 ± 0.20	2.0
Nonnative		
<i>Ictalurus</i> sp.	6.55 ± 0.75	56.9
Smallmouth Bass	0.90 ± 0.20	7.8
Yellow Bullhead	2.50 ± 0.30	21.5
Western Mosquitofish	1.50 ± 0.80	11.8

Black Canyon Creek

Black Canyon Creek consisted of mostly native fish as well as nonnative Brown Trout and Rainbow Trout (Table 13). Unlike the East Fork Gila River and its headwater streams, small bodied fish including Longfin Dace and Speckled Dace were present.

Table 13. Mean density by species (fish/100m² ± SE) for 2 sites sampled at Black Canyon in 2019.

Species	Density	Percent Composition
Native		
Desert Sucker	3.33 ± 0.38	22.8
Gila Trout	0.10 ± 0.06	0.8
Longfin Dace	1.63 ± 1.28	11.3
Roundtail Chub	0.03 ± 0.03	0.3
Sonora Sucker	1.40 ± 0.35	9.6
Speckled Dace	7.77 ± 2.44	52.5
Nonnative		
Brown Trout	0.13 ± 0.13	0.8
Rainbow Trout/ Hybrid	0.27 ± 0.22	1.9

Diamond Creek

No nonnative fish were captured in Diamond Creek (Table 14). Longfin Dace and Speckled Dace were present along with Desert Sucker and Sonora Sucker.

Table 14. Mean density by species (fish/100m² ± SE) for 3 sites sampled at Diamond Creek in 2019.

Species	Density	Percent Composition
Native		
Desert Sucker	4.07 ± 1.64	12.7
Longfin Dace	9.17 ± 7.81	30.2
Sonora Sucker	10.8 ± 2.91	33.2
Speckled Dace	7.67 ± 2.34	23.9

Taylor Creek

Taylor Creek is unique because Largemouth Bass *Micropterus salmoides* are present. The only small bodied fish that were captured in Taylor Creek were Western Mosquitofish (Table 15).

Table 15. Mean density by species (fish/100m² ± SE) for 2 sites sampled at Taylor Creek in 2019.

	Species	Density	Percent Composition
Native			
	Desert Sucker	3.45 ± 3.45	13.2
	Sonora Sucker	0.50 ± 0.50	7.4
Nonnative			
	Largemouth Bass	6.10 ± 6.10	19.1
	Smallmouth Bass	0.30 ± 0.30	4.4
	Western Mosquitofish	0.40 ± 0.40	5.9
	Yellow Bullhead	3.90 ± 3.00	50.0

Recommendations

- In 2020, we recommend continuing surveys of Black Canyon Creek and any tributaries to cover the approximately 10 miles of Black Canyon Creek with unknown species occupancy.

Work Planned for 2020

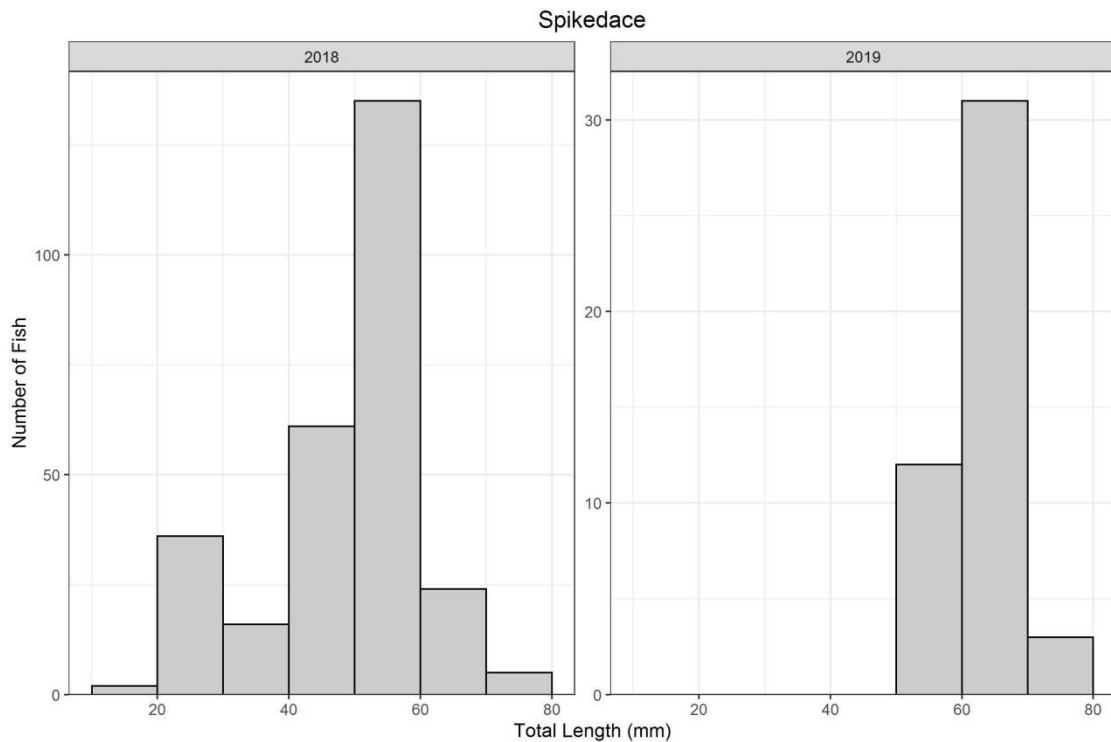
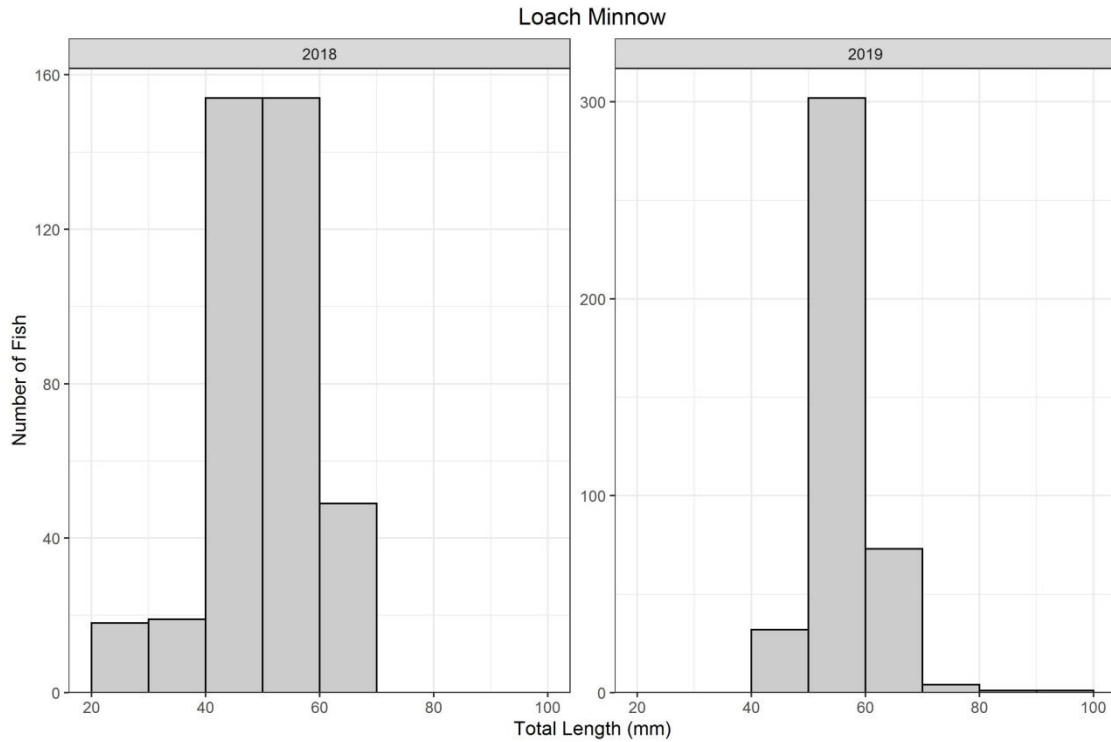
- Survey Black Canyon and Apache Creek and any other perennial tributaries.

References

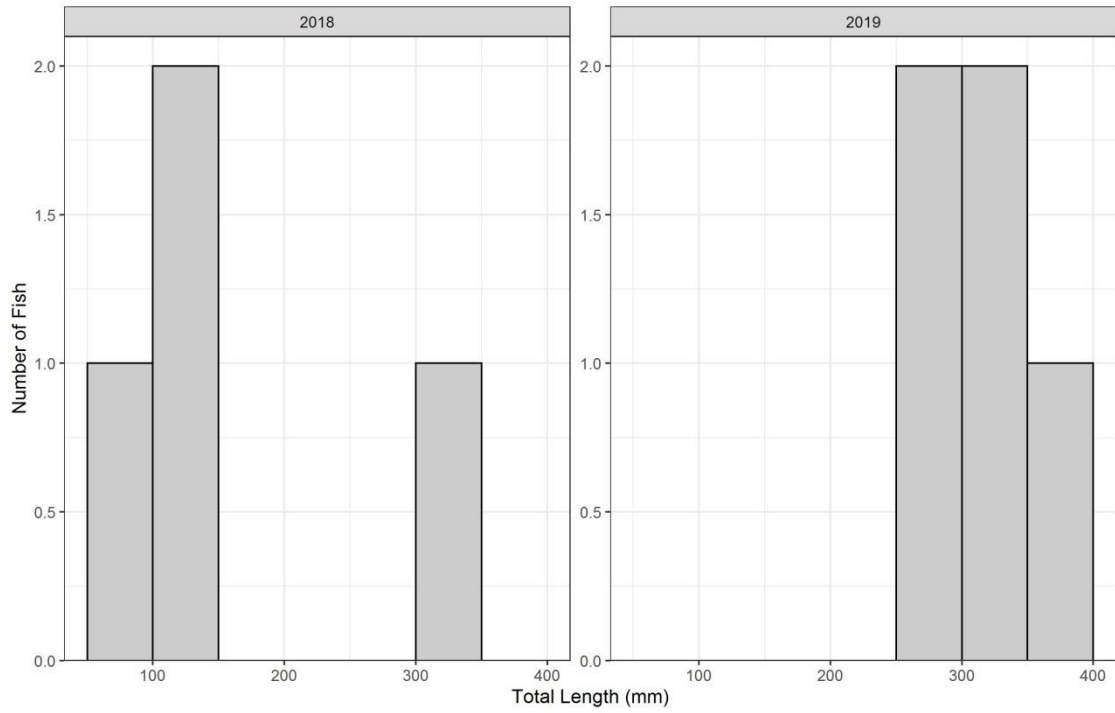
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Appendix A.

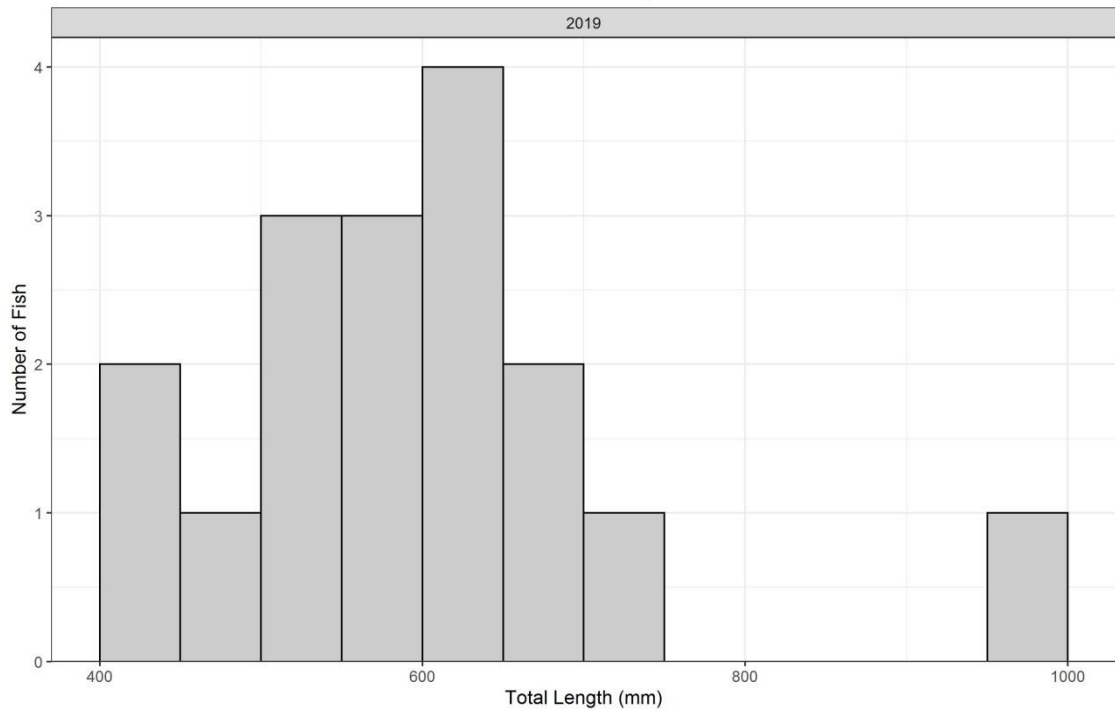
Length frequency of selected species collected during the nonnative removal on the West Fork Gila River from June 25-29, 2018 (left) and June 10-13, 2019 (right). No common carp were captured in 2018 and not all individuals were measured.



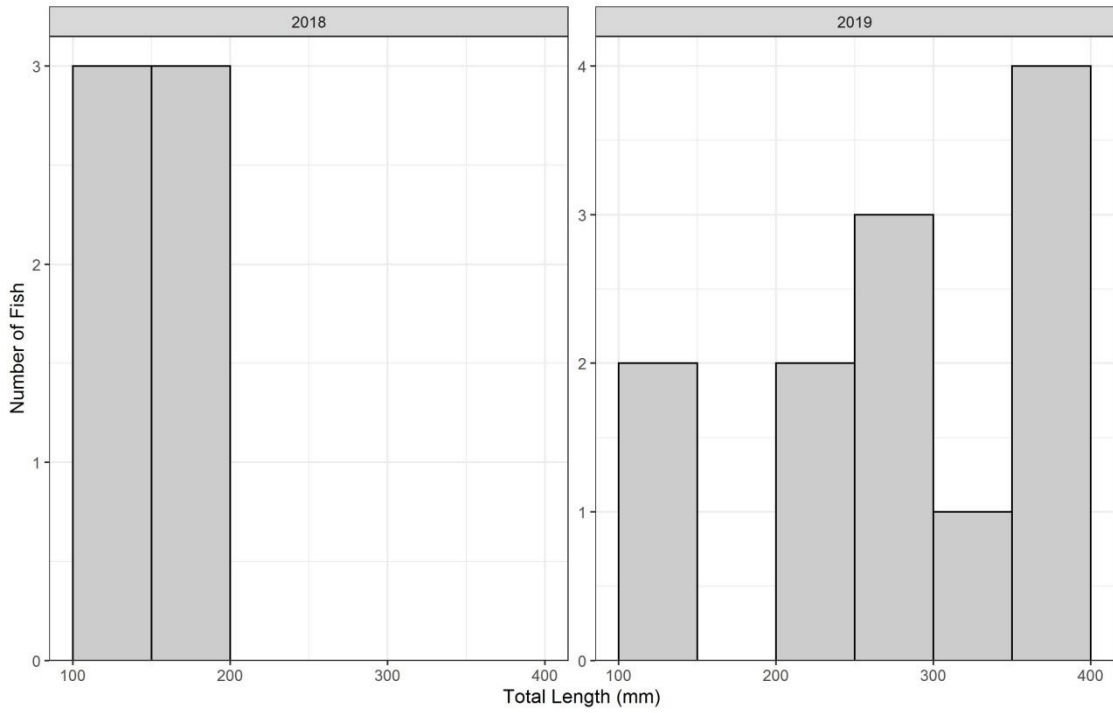
Roundtail Chub



Common Carp



Smallmouth Bass



Yellow Bullhead

