Gila River Basin Native Fishes Conservation Program:

New Mexico Department of Game and Fish Native Fish Conservation Efforts

2020 Annual Report

Cooperative Agreement (15AC00046) Between

Bureau of Reclamation

And

New Mexico Department of Game and Fish

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New Mexico Department of

Game and Fish

Fisheries Management Division

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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 2020. From 1 January to 30 September 2020 work was conducted under a Cooperative Agreement (15AC00046) between the Bureau of Reclamation (BOR) and the New Mexico Department of Game and Fish (Department), since 1 October a new Agreement has been anticipated but not executed between the parties. However, pre-agreement costs have been approved by the BOR and the anticipation of a new agreement allowed work to continue through the end of the calendar year. Three ongoing native fish conservation efforts were conducted in 2020: removal of nonnative fishes from the West Fork Gila River, Threatened and Endangered (T&E) fish repatriations and monitoring, and remote site inventory. One new native fish conservation effort was added to the agreement, permanent site monitoring in the Gila River Basin. The West Fork Gila River nonnative removal was completed in June 2020. Six nonnative species were captured and removed. Surveys were conducted to assess the success of repatriation of Loach Minnow *Tiaroga cobitis* in Saliz Canyon. Spikedace *Meda fulgida* and Loach Minnow were surveyed in the San Francisco River to assess repatriation success. Negrito Creek was surveyed for Loach Minnow and any potential habitat for other priority species. Loach Minnow were salvaged from Bear Creek due to threats from the Tadpole Fire and transferred to the Arizona Game and Fish Department (AZGFD) Aquatic Research and Conservation Center (ARCC). Sites on Black Canyon Creek were surveyed and intermittent reaches documented, completing the East Fork Gila River inventory. 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 effects 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: Gila Chub *Gila intermedia* (now classified as Roundtail Chub *Gila robusta*), Gila Topminnow *Poeciliopsis occidentalis*, Loach Minnow, Razorback Sucker *Xyrauchen texanus* and Spikedace. 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 Arizona Game and Fish Department (AZGFD). The Department receives funds from the BOR for work fitting these objectives under Cooperative Agreements (15AC00046 from 2015 to 30 September 2020, agreement pending for 1 October 2020 to present). 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 2020, this report lists the GRBNFCP Strategic Plan goal(s) the task works toward achieving (USFWS et al. 2018), followed by associated recovery objective(s) listed 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 2020 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 2021.

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 recreational fishing opportunities and support 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 Heart Bar 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 mesohabitat. 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 (seconds), habitat type, and area (m^2) sampled. Total length (to the nearest mm) and weight (to the nearest gram) are collected for the first 50 individuals of each species captured each day; after 50 lengths and weights have been recorded the remaining small-bodied fish are enumerated by species and the total length of all large-bodied fish species is recorded. The removal is conducted annually in June, requires a crew of 6 to 9 people, and usually takes 4 to 5 days to complete. The same stretch of river is sampled annually. However, 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 this effort reduced biomass of some nonnative species and increased Spikedace biomass. The GRBNFCP decided to continue the effort because of the documented reduction of nonnative species.

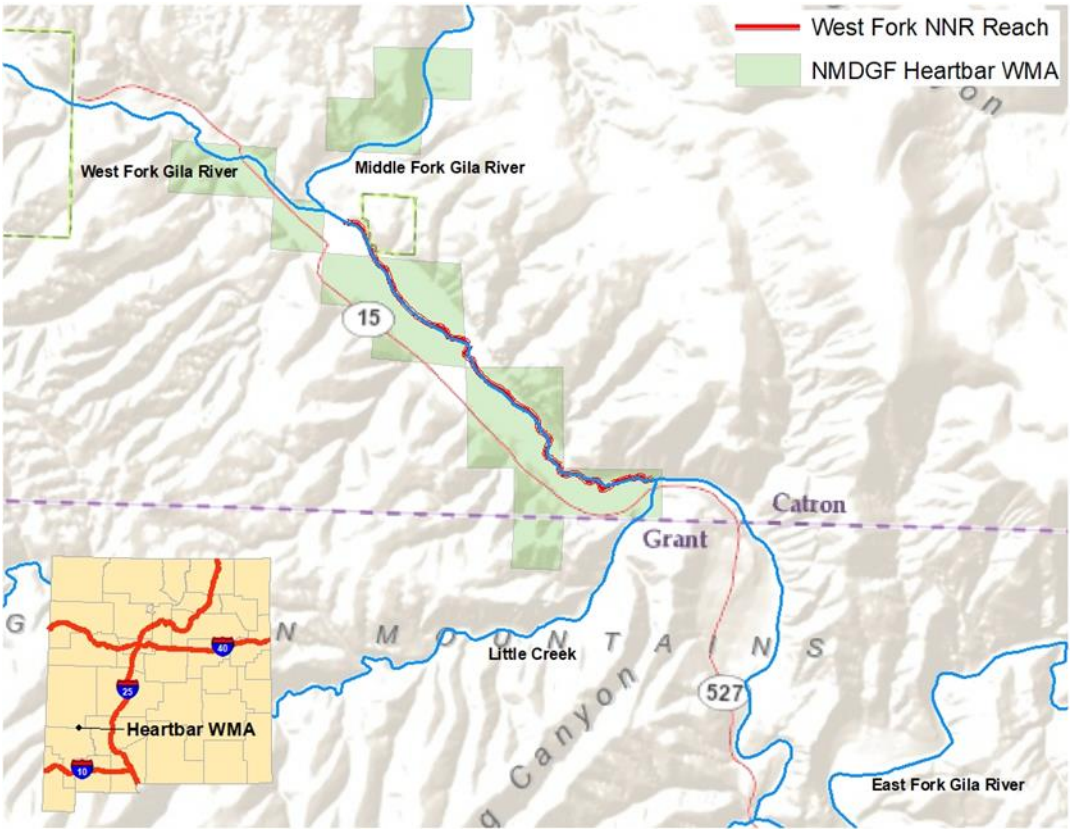

Figure 1. Map showing the location of the West Fork Gila River nonnative fish removal.

Results

Department, USFWS, and USFS staff conducted the West Fork Gila River nonnative removal from June 1 to June 4, 2020. The effort consisted of 40,280 seconds of electrofishing. Number and density of fishes

captured in 2020, excluding unidentifiable Catostomids (< 30 mm), are shown in Table 1. Sonora Sucker *Catostomus insignis*, Longfin Dace *Agosia chrysogaster*, and Desert Sucker *Catostomus clarkii* were the most abundant native species (Figure 2). Western Mosquitofish *Gambusia affinis* were the most abundant nonnative species, Smallmouth Bass density increased since 2018, and Yellow Bullhead density decreased compared to 2019 (Figure 3). Many young-of-year Roundtail Chub were captured during the survey, 18 were under 100 mm (Appendix A). Gravid Yellow Bullhead females were documented during the removal. Run habitat was the most commonly sampled habitat throughout the removal reach (Table 2).

Table 1. Total number of individuals captured and density of all fishes in the West Fork Gila River nonnative removal in 2020.

	Species	Number Captured	Density (fish/100 m^2)
Native			
	Desert Sucker	643	6.78
	Loach Minnow	349	2.05
	Longfin Dace	463	2.72
	Roundtail Chub	25	0.15
	Sonora Sucker	1062	6.24
	Speckled Dace	114	0.67
	Spikedace	220	1.29
Nonnative			
	Black Bullhead	5	0.03
	Brown Trout	2	0.01
	Common Carp	2	0.01
	Smallmouth Bass	21	0.12
	Western Mosquitofish	123	0.72
	Yellow Bullhead	89	0.52

Table 2. Area sampled and percent composition of all habitat types sampled on the West Fork Gila nonnative removal in 2020.

Habitat Type	Area Sampled (m^2)	Percent Composition
Backwater	177	1.04
Plunge	149	0.87
Pool	2317	13.60
Riffle	1297	7.61
Run	8663	50.87
Shoal	969	5.69
Shoreline Pool	261	1.53
Shoreline Run	3198	18.78

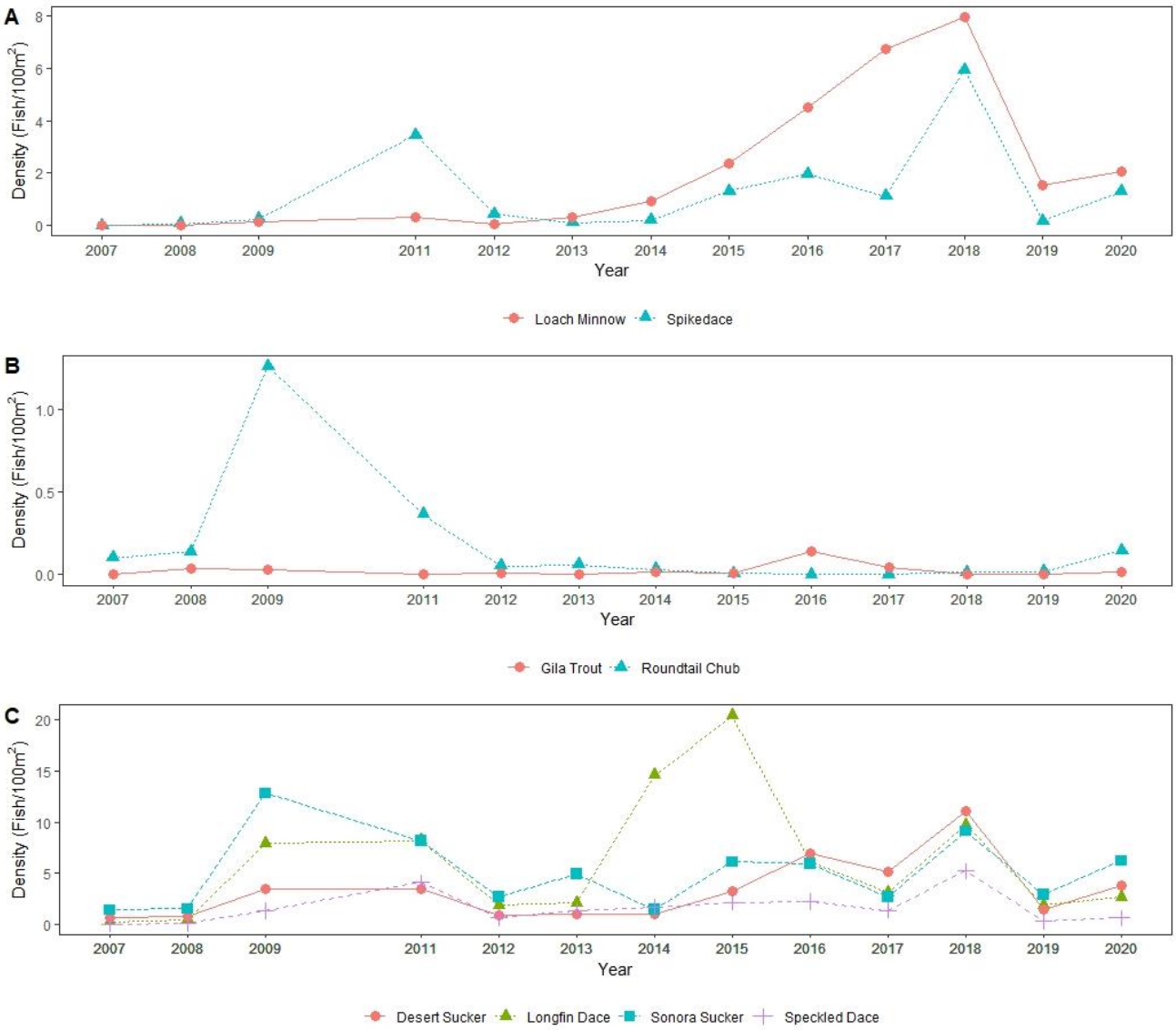

Figure 2. Overall density of native fish species captured in the West Fork Gila River nonnative removal from 2007 to 2020. Data from 2006 and 2010 are excluded because habitat measurements were not recorded. For clarity, charts are split into priority species (A), low density species (B), and all other native fish species (C).

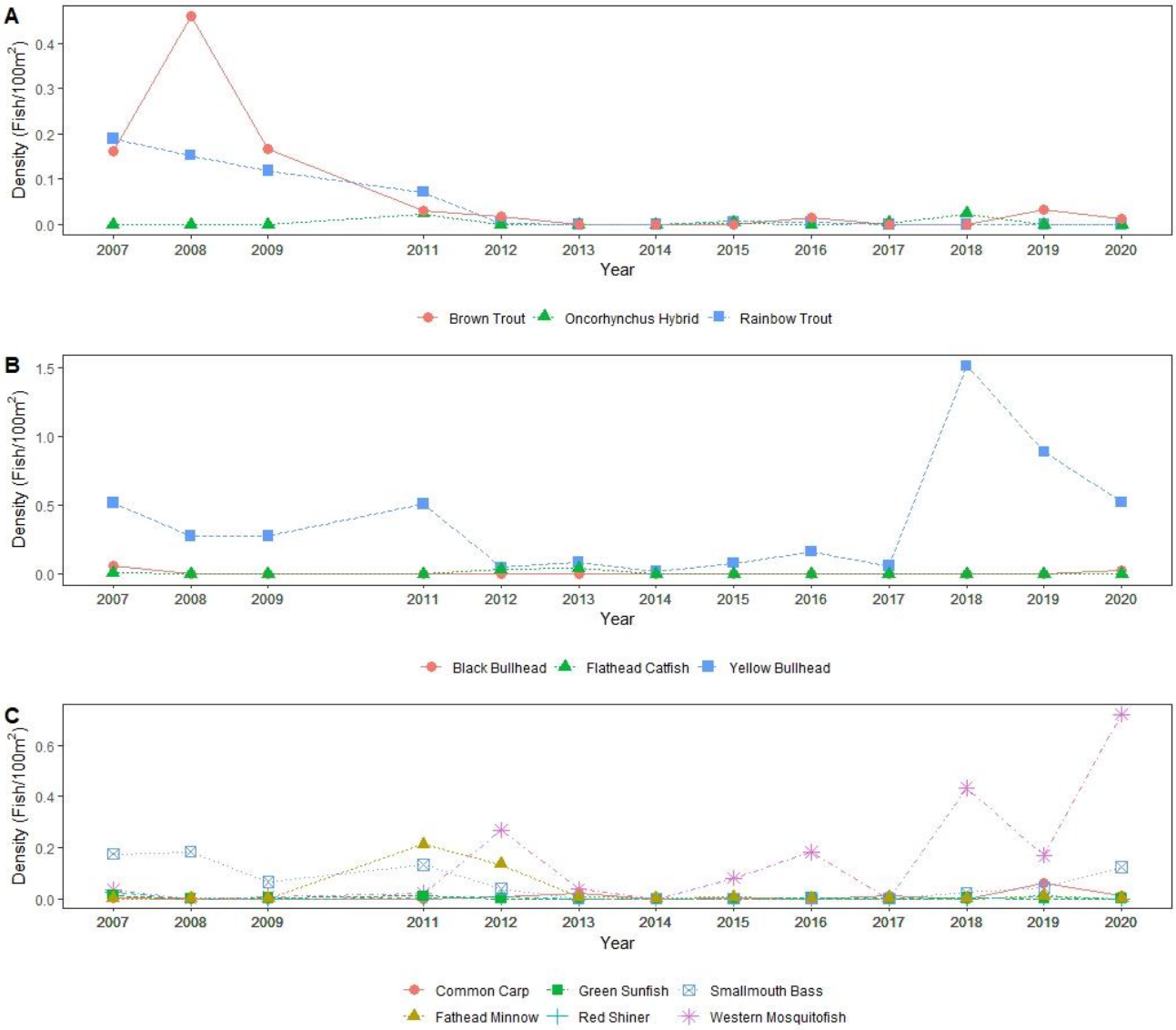

Figure 3. Overall density of nonnative fish species captured in the West Fork Gila River nonnative removal from 2007 to 2020. Data from 2006 and 2010 are excluded because habitat measurements were not recorded. For clarity, charts are split into salmonid species (A), catfish and bullhead species (B), and all other nonnative fish species (C).

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 2021

- Conduct West Fork Gila River nonnative removal on 4 km Heart Bar Wildlife Management Area reach in June 2021.

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

- 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 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 where repatriation might occur. 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 2020, including post-repatriation surveys and fish collection.

Bear Creek

The Tadpole Fire burned the headwaters of Bear Creek in 2020. To mitigate the potential for negative effects from the fire, 221 Loach Minnow were salvaged from Bear Creek on July 7, 2020 and transferred to ARCC. Loach Minnow will be restocked into Bear Creek when it is considered stable.

Negrito Creek

Department and USFS staff surveyed Negrito Creek on July 9, 2020. Negrito Creek is a tributary to the Tularosa River in the San Francisco River drainage (Figure 4). Access is difficult due to private land located at the mouth of Negrito Creek. Staff opportunistically surveyed possible Loach Minnow habitat and only recorded species observed. One Loach Minnow was captured in 816 seconds of electrofishing. Desert Sucker, Longfin Dace, Sonora Sucker, and Speckled Dace *Rhinicthys osculus* were also captured. Negrito Creek is intermittent at the location sampled. Some deep pool habitat was found that was unable to be effectively sampled. This survey confirms presence of Loach Minnow in Negrito Creek however future surveys need to be conducted to determine distribution and abundance.

Saliz Canyon

Stocking Loach Minnow into Saliz Canyon began in 2016 (Table 3). Stocking was postponed in 2018 due to habitat degradation resulting from the Owl Fire (Ferguson and Wick 2019). 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. Loach Minnow stocking resumed in 2019. The first repatriation survey at the stocking location was conducted in 2020. Six Loach Minnow were captured along with other native fishes (Table 4). All Loach Minnow captured were under 38 mm total length, and two were 25 and 26 mm total length, indicating natural reproduction is occurring. Saliz Canyon should continue to be stocked with Loach Minnow when available and repatriation surveys should continue.

Table 3. Summary of Loach Minnow stocking into Saliz Canyon.

Date	Number Stocked	Source (population)
November 16, 2016	103	Tularosa River
November 29, 2017	243	ARCC (San Francisco)
June 3, 2019	305	ARCC (San Francisco)

Table 4. Total number of fishes captured, percent composition, and density in Saliz Canyon at the Loach Minnow stocking location.

Species	Number Caught	Percent Composition	Density (fish/100 m^2)
Desert Sucker	1	0.16	124.90
Loach Minnow	6	0.94	3.66
Longfin Dace	205	32.18	124.90
Speckled Dace	425	66.72	258.94

Figure 4. Map displaying the upper San Francisco River Basin with all sites sampled in the basin in 2020 including Negrito Creek.

San Francisco River

Spikedace were stocked into the San Francisco River in 2008, 2009, 2010, and 2014. Early stockings (pre-2012) were considered unsuccessful due to the effects of the Whitewater Baldy Fire (NMDGF 2016). Spikedace were first found at the annual monitoring site in October 2017. The permanent site is approximately 15 miles downstream of the stocking location (Figure 4). Spikedace were stocked again in

November 2017 at the original stocking near Cosmic Campground (Ferguson and Ruhl 2018). Spikedace were captured at the Glenwood site again in 2019 and 2020. Surveys throughout the San Francisco River on July 7 and July 8, 2020 showed Spikedace establishing and distributing through much of the San Francisco River, with the highest density occurring at the Cosmic Campground stocking location (Figure 5).

Loach Minnow were salvaged from the San Francisco River Glenwood site after the Whitewater Baldy Fire in June 2012 and subsequently restocked in 2014 (NMDGF 2016). Since that stocking, Loach Minnow have been captured annually at the permanent site. Loach Minnow were also captured downstream below Pleasanton, NM during 2020 surveys (Table 5).

Populations of both Loach Minnow and Spikedace are persisting in the San Francisco River. Populations are considered established and will continue to be monitored at the annual monitoring site and other locations as needed. Future stocking will be conducted as needed, but is not necessary at this time.

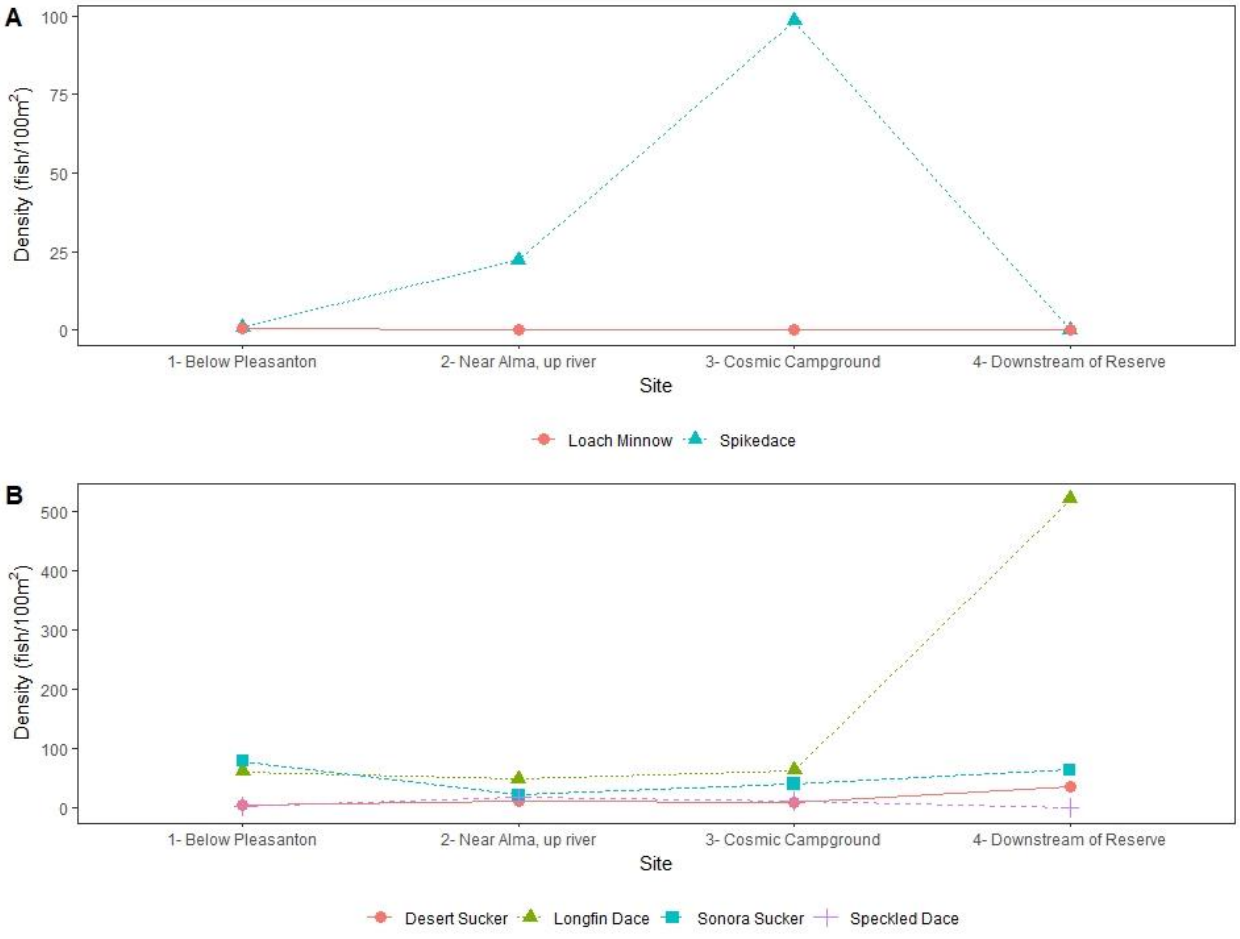

Figure 5. Density of native fishes captured in the San Francisco River surveys, moving upstream (left to right). For clarity, charts are split into priority species (A), and all other fishes captured (B).

Table 5. Total number of fish captured by species, percent composition, and density at each site sampled on the San Francisco River.

Site	Species	Number Captured	Percent Composition	Density (fish/100 m^2)
Below Pleasanton				
	Desert Sucker	17	3.46	5.29
	Flathead Catfish	3	0.61	0.93
	Loach Minnow	2	0.41	0.62
	Longfin Dace	198	40.24	61.62
	Red Shiner	1	0.20	0.31
	Sonora Sucker	255	51.83	79.36
	Speckled Dace	10	2.03	3.11
	Spikedace	3	0.61	0.93
	Western Mosquitofish	1	0.20	0.31
Upstream of Alma				
	Desert Sucker	25	8.99	11.05
	Longfin Dace	112	40.29	49.52
	Sonora Sucker	50	17.99	22.11
	Speckled Dace	40	14.39	17.69
	Spikedace	50	17.99	22.11
Cosmic Campground				
	Desert Sucker	24	4.36	9.80
	Longfin Dace	156	28.31	63.70
	Sonora Sucker	100	18.15	40.83
	Speckled Dace	30	5.44	12.25
	Spikedace	241	43.74	98.41
Downstream of Reserve				
	Desert Sucker	77	5.87	37.12
	Longfin Dace	1081	82.46	521.06
	Sonora Sucker	133	10.14	64.11
	Speckled Dace	1	0.08	0.48
	Western Mosquitofish	1	0.08	0.48

Recommendations

- Bear Creek should be evaluated for fire effects and Loach Minnow should be restocked when stream is stable and restocking is necessary.
- Additional areas of Negrito Creek should be surveyed to investigate Loach Minnow distribution and evaluate nonnative threats.
- Saliz Canyon should continue to be stocked with Loach Minnow. With the effects of the Owl Fire, it is possible 2019 is the first stocking with Loach Minnow survival. Repatriation surveys should continue and be expanded to additional sites to assess dispersal if Loach Minnow continue to persist.

- The San Francisco River will continue to be monitored through annual permanent site sampling and future remote site inventory work. There is no need for more repatriation surveys at this time.

Work Planned for 2021

- Stock Loach Minnow into Saliz Canyon.
- Survey Saliz Canyon, Bear Creek, and Negrito Creek.
- Assess lower Sapillo Creek as potential repatriation stream for Loach Minnow and Spikedace.
- Assess tanks in the Harden Cienega Creek drainage in New Mexico for nonnative fish with AZGFD.

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. Prior to 2019 no thorough assessment had been conducted since the GRBNFCP funded an inventory of each of the Gila River forks from 2005-2008 (Paroz et al.

2009). Our goal is to repeat the previous sites surveyed, as well as sample additional sites throughout the East Fork Gila River and its tributaries.

Results

Department, USFWS, and USFS staff surveyed the East Fork Gila River from May 6 to May 10, 2019 (Ferguson and Zeigler 2020). A total of 26 sites were surveyed on the East Fork Gila River, Black Canyon Creek, and Apache Creek. Approximately 8 miles of Black Canyon Creek remained to be surveyed in 2020. Department, USFWS, and USFS completed Black Canyon Creek sampling on June 24 and 25, 2020. 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). Sampling in 2020 occurred from where 2019 sampling ended to the Gila Trout barrier (Figure 6). Intermittent and dry reaches of Black Canyon Creek prevented sampling at several sites.

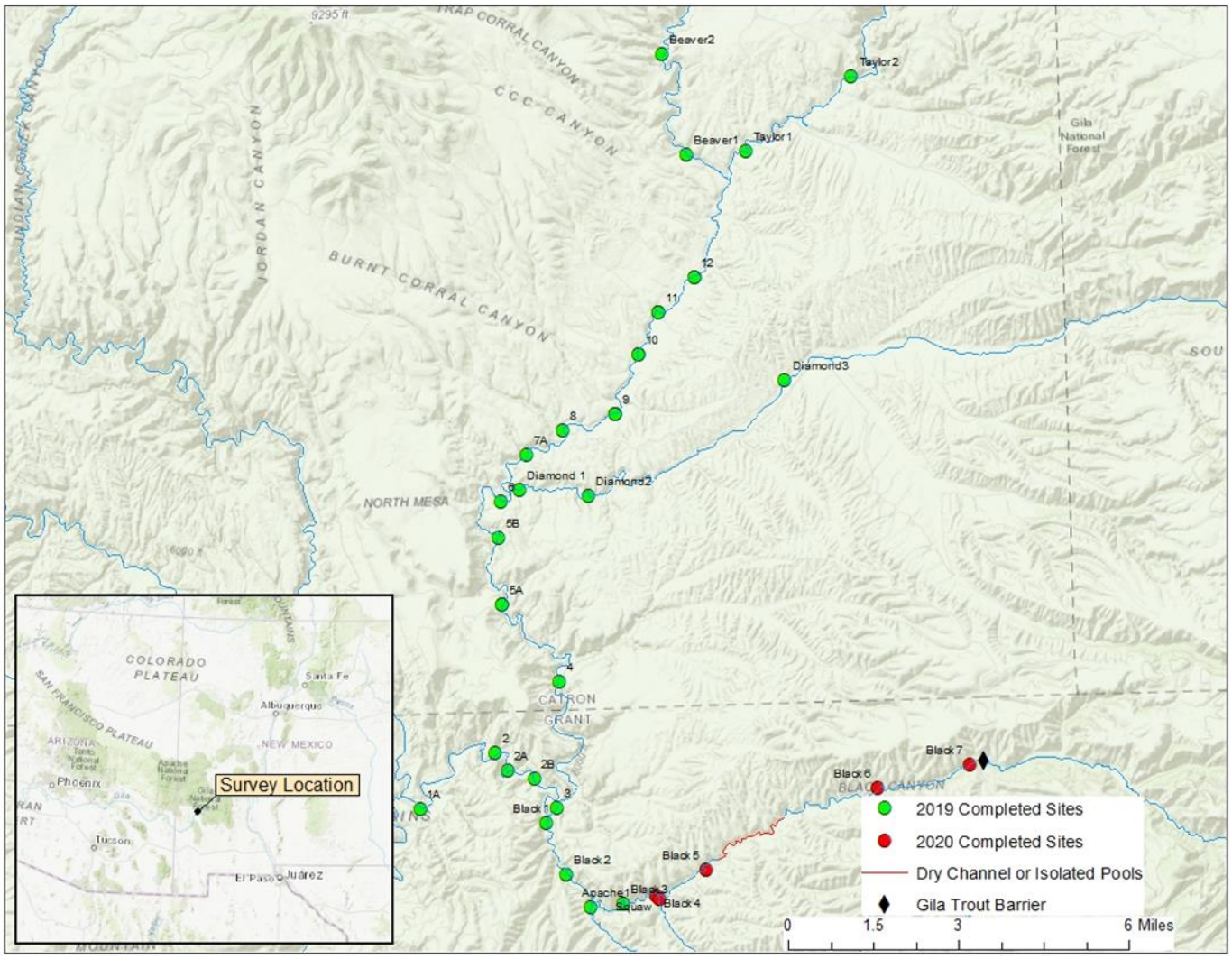

Figure 6. Map of East Fork Gila River and tributaries showing location of sites sampled in 2019 and Black Canyon Creek sites sampled in 2020.

The fish community in Black Canyon Creek consisted of mostly native species as well as nonnative Brown Trout, Rainbow Trout, and *Oncorhynchus* hybrids (Table 6). Unlike the East Fork Gila River and its headwater streams, small-bodied fishes including Longfin Dace and Speckled Dace were present (Table 7). The most abundant species at all sites was Speckled Dace (Figure 7). Roundtail Chub were only captured at the lowest site. Salmonids were the only nonnative species captured, with the highest densities near the Squaw Creek confluence, located between sites 4 and 5 (Figure 8). Squaw Creek had a coldwater fish assemblage (Table 8).

Table 6. Total number of individuals captured and density (fish/100m^2) of all fishes by site in Black Canyon Creek in 2019 and 2020.

	Desert Sucker		*Gila Trout*		*Longfin Dace*		*Roundtail Chub*		*Sonora Sucker*		*Speckled Dace*		*Brown Trout*		*Rainbow Trout/ Hybrid*	
Site	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density	# Captured	Density
Black1	30	3.5	0		36	4.2	1	0.1	6	0.7	55	6.4	0		0	
Black2	23	2.6	1	0.1	3	0.3	0		16	1.8	39	4.4	0		1	0.1
Black3	32	3.9	2	0.2	3	0.4	0		14	1.7	102	12.5	3	0.4	6	0.7
Black4	5	1.8	0		5	1.8	0		6	2.1	128	45.1	18	6.3	42	14.8
Black5	19	10.6	0		2	1.1	0		6	3.4	161	90.1	7	3.9	11	6.2
Black6	2	1.9	2	1.9	16	15.4	0		0		141	136	0		0	
Black7	0		22	11.9	5	2.7	0		0		94	50.7	0		0	

Table 7. Density (mean ± SE) of native fishes for all sites sampled in Black Canyon Creek in 2019 and 2020.

	Species	Density (fish/100 m^2)	Percent Composition
Native			
	Desert Sucker	3.48 ± 1.29	10.42
	Gila Trout	2.02 ± 1.66	2.54
	Longfin Dace	3.70 ± 2.02	6.57
	Roundtail Chub	0.02 ± 0.02	0.09
	Sonora Sucker	1.39 ± 0.46	4.51
	Speckled Dace	49.30 ± 18.51	67.61
Nonnative			
	Brown Trout	1.52 ± 0.97	2.63
	Oncorhynchus Hybrid	2.75 ± 1.90	5.07
	Rainbow Trout	0.36 ± 0.24	0.56

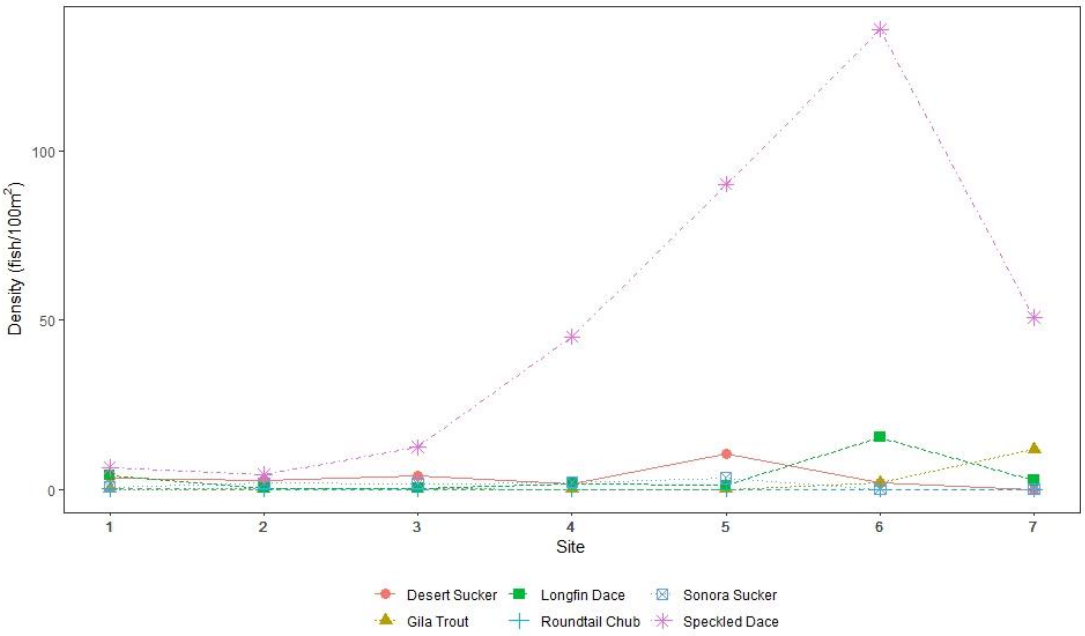

Figure 7. Density of native fishes captured in the Black Canyon Creek moving upstream from the confluence of the Gila River (left to right).

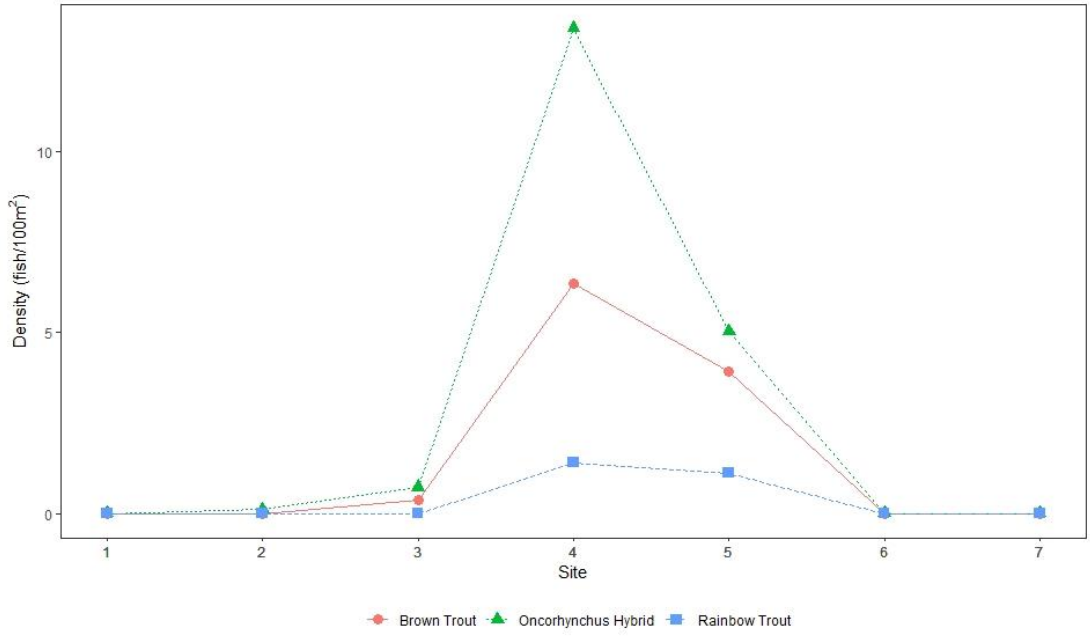

Figure 8. Density of nonnative fishes captured in Black Canyon Creek moving upstream from the confluence of the Gila River (left to right).

Table 8. Density by species for 1 site sampled at Squaw Creek in 2020.

	Species	Density (fish/100 m^2)	Percent Composition
Native			
	Speckled Dace	27.79	63.33
Nonnative			
	Brown Trout	6.83	15.56
	Oncorhynchus Hybrid	5.85	13.33
	Rainbow Trout	3.41	7.78

Recommendations

- The East Fork Gila drainage may have low numbers of Roundtail Chub persisting. Aside from the lowest reaches of the East Fork, Loach Minnow and Spikedace no longer appear to be in the system. The East Fork should remain in the remote site survey rotation, however due to lack of priority species the drainage has the lowest priority of the remote sites being inventoried for native fish. Without a terminal barrier and removal of nonnative fishes, establishment of Loach Minnow and Spikedace populations in the East Fork Gila drainage seems unlikely. At this time the Department's Fisheries Management Plan prioritizes the management of wild Smallmouth Bass and Channel Catfish sportfish populations in that area (NMDGF 2016).

Work Planned for 2021

- Survey the lower West Fork Gila River and any perennial tributaries.

Gila River Basin Permanent Site Monitoring (Task NM-2020-1)

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

Annual monitoring of five sites in the Gila River Basin has been completed since 1988. An additional four sites have been added since 1989 (Table 9). This annual sampling is conducted to track changes in presence and density of native and nonnative fishes throughout the Gila River Basin. Data from this effort informs recovery actions for priority species throughout the basin. There are nine permanent sites monitored annually in the Gila River Basin (Figure 9).

Table 9. Gila River Basin permanent site sampling history by waterbody and site.

Waterbody	Site Name	Years Sampled	Previous Sites
East Fork Gila River	Fall Springs	1996-present	1988-1995, 4 km upstream
Gila River	Ash Canyon	2012-present	1997-2011, 5 km upstream (previously Middle Box)
Gila River	Cherokee Canyon	2009-present	2009-2019
Gila River	Fisherman's Overlook	1997-2008	
Gila River	Iron Bridge	1988-present	
Gila River	Sunset Diversion	2014-present	2010-2013, above diversion
Middle Fork Gila River	Trailhead	1988-present	
San Francisco River	Glenwood Ranger Station	1997-present	1988-1997, 1 km upstream
Tularosa River	Eagle Peak Road	1988-present	
West Fork Gila River	Gila Cliff Dwellings	1989-present	

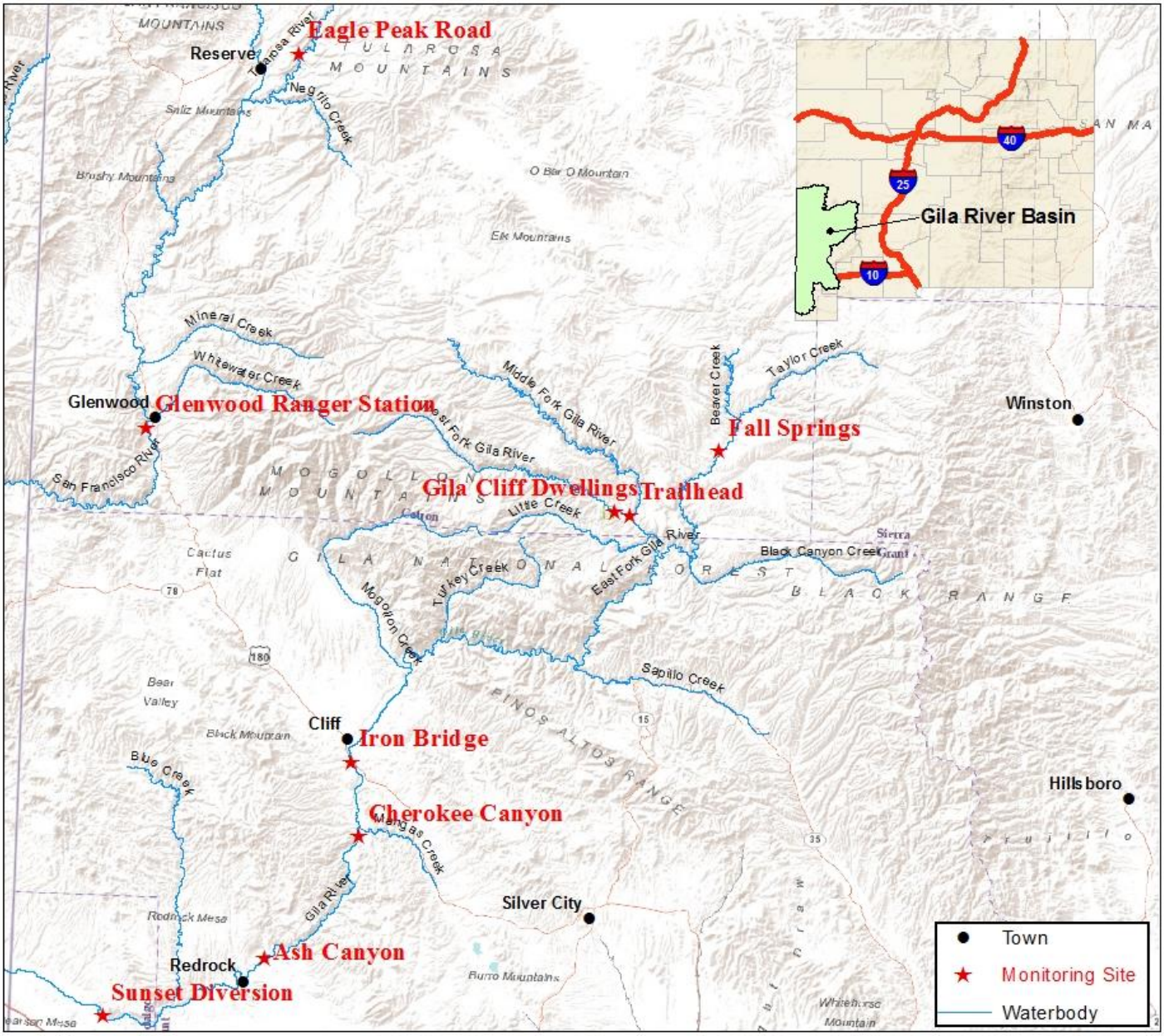

Figure 9. Map displaying nine annual monitoring sites throughout the Gila River Basin.

Results

Results from permanent site monitoring in 2020 are listed below by site. A brief summary of historical findings are included to provide a reference point for these results and track long-term community trends. Two separate crews completed monitoring of the sites in 2020. Although Department personnel did not survey all sites, all sites are reported below to keep long term reporting in one document.

East Fork Gila River—Fall Springs

Sampling began at the East Fork Gila River Fall Springs site in 1988. The site was shifted downstream from its original location on private property to the Gila National Forest in 1996. The new site has similar characteristics to the original site and data from the two sites have been combined for long term reporting. Loach Minnow have not been captured at the site since 1999 and Spikedace have not been captured since 2000 (Table 10). Sonora Sucker was the most abundant species captured in 2020 (Table 11). The majority of the habitat sampled within the site consisted of riffles (Table 12).

Table 10. Occurrence of fishes at East Fork Gila River Fall Springs site, Catron County, New Mexico, 1988-2020. X indicates species presence.

		Year																																
	Species	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																																		
	Desert Sucker	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
	Loach Minnow		X	X								X	X																					
	Longfin Dace	X	X	X	X	X	X	X	X		X	X	X	X					X		X													
	Roundtail Chub	X	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X		X		X								
	Sonora Sucker	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Speckled Dace	X								NO COLLECTION					X	X								X										
	Spikedace	X	X	X			X						X	X																				
Nonnative																																		
	Channel Catfish	X	X																								X							
	Catfish spp.			X	X	X	X	X	X					X				X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
	Fathead Minnow	X		X			X							X																				
	Green Sunfish																	X	X		X	X	X			X								
	Largemouth Bass						X				X								X										X					
	Smallmouth Bass				X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Western Mosquitofish	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Yellow Bullhead												X				X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	

Table 11. Number captured, relative species abundance, and density for each species captured at the East Fork Gila River Fall Springs site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Catfish spp.	3	8.11	1.23
Desert Sucker	8	21.62	3.28
Sonora Sucker	17	45.95	6.96
Smallmouth Bass	9	24.32	3.68

Table 12. Area sampled, habitat composition, depth (mean ± SE, if n>1), and mean velocity (mean ± SE, if n>1) of all habitat types sampled within the East Fork Gila River Fall Springs site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Pool	58	23.8	0.63±0.04	0.02±0.02
Riffle	75	30.9	0.23±0.01	0.78±0.02
Run	55	22.5	0.33	0.74
Shoreline Run	56	22.8	0.35±0.01	0.43±0.07

Gila River—Ash Canyon

Sampling began at the Gila River Middle Box site in 1997. To allow for better access, the site was shifted slightly downstream from its original location to the Ash Canyon confluence in 2012. The new site, located on the Department's Redrock property, has similar characteristics to the original site and data from the two sites have been combined for long term reporting. Since 1997, 11 fish species have been collected at the site (Table 13). Longfin Dace and Red Shiner densities increased in 2020 compared to 2019 (Figure 10). Longfin Dace was the most abundant species captured in 2020 (Table 14). Runs were the most common habitat sampled within the site (Table 15).

Table 13. Occurrence of fishes at Gila River Ash Canyon site, Grant County, New Mexico, 1997-2020. X indicates species presence.

		Year																						
	Species	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																									
	Desert Sucker	X	X	X		X	X	X	X	X		X	X	X	X	X	X		X	X	X	X		X	X
	Loach Minnow	X	X	X		X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Longfin Dace	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
	Sonora Sucker	X	X	X		X	X	X					X	X	X	X			X	X	X			X	X
	Spikedace	X	X	X		X		X	X				X		X										X
Nonnative																									
	Channel Catfish		X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X
	Common Carp											X			X		X		X			X			X
	Fathead Minnow		X			X		X	X	X		X	X	X	X	X	X	X			X		X		X
	Flathead Catfish					X	X	X		X				X			X		X		X	X			
	Red Shiner	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Western Mosquitofish					X	X	X					X			X		X			X		X	X	X

NO MONITORING

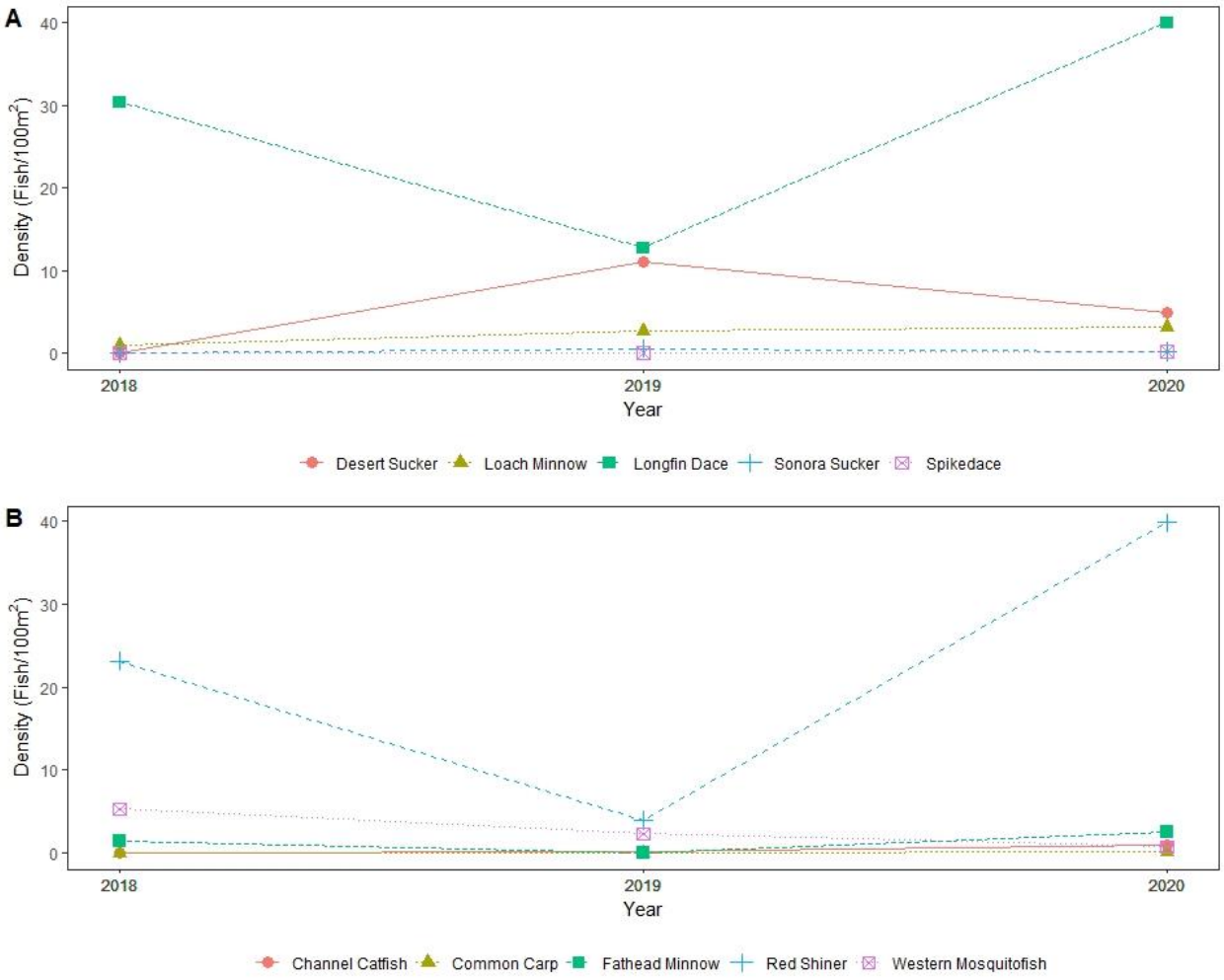

Figure 10. Density of native fishes (A) and nonnative fishes (B) at Gila River Ash Canyon site in 2018, 2019, and 2020.

Table 14. Number captured, relative species abundance, and density for each species captured at the Gila River Ash Canyon site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Channel Catfish	6	0.97	0.90
Common Carp	1	0.16	0.15
Desert Sucker	33	5.36	4.96
Fathead Minnow	17	2.76	2.55
Loach Minnow	21	3.41	3.16
Longfin Dace	266	43.18	39.96
Red Shiner	265	43.02	39.81
Sonora Sucker	1	0.16	0.15
Spikedace	1	0.16	0.15
Western Mosquitofish	5	0.81	0.75

Table 15. Area sampled, habitat composition, depth (mean ± SE, if n>1), velocity (mean ± SE, if n>1) of all habitat types sampled within the Gila River Ash Canyon site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Riffle	88	13.2	0.08	0.27
Run	298	44.8	0.12±0.02	0.22±0.05
Shoal	142	21.3	0.14±0.02	0.06±0.02
Shoreline Pool	62	9.3	0.21±0.06	0.12±0.09
Shoreline Run	76	11.4	0.21	0.07

Gila River—Cherokee Canyon

Sampling at the Gila River Cherokee Canyon site began in 2009. Several native fish species have commonly been collected at the site (Table 16). Spikedace and Loach Minnow density increased in 2020 compared to 2019 (Figure 11). The only nonnative fish present in 2020 were small-bodied species at low densities (Table 17). Shoals were the most common habitat sampled (Table 18).

Table 16. Occurrence of fishes at the Gila River Cherokee site, Grant County, New Mexico, 2009-2020. X indicates species presence.

		Year											
	Species	09	10	11	12	13	14	15	16	17	18	19	20
Native													
	Desert Sucker	X	X	X	X		X	X	X	X	X	X	X
	Loach Minnow	X	X	X	X			X	X	X	X	X	X
	Longfin Dace	X	X	X	X	X	X	X	X	X	X	X	X
	Sonora Sucker	X	X	X	X		X	X	X	X	X	X	X
	Spikedace	X	X	X						X		X	X
Nonnative													
	Channel Catfish									X		X	
	Common Carp									X		X	
	Fathead Minnow	X					X				X	X	X
	Flathead Catfish			X	X		X	X		X			
	Red Shiner										X	X	X
	Western Mosquitofish	X		X	X	X		X	X	X	X	X	
	Yellow Bullhead		X										

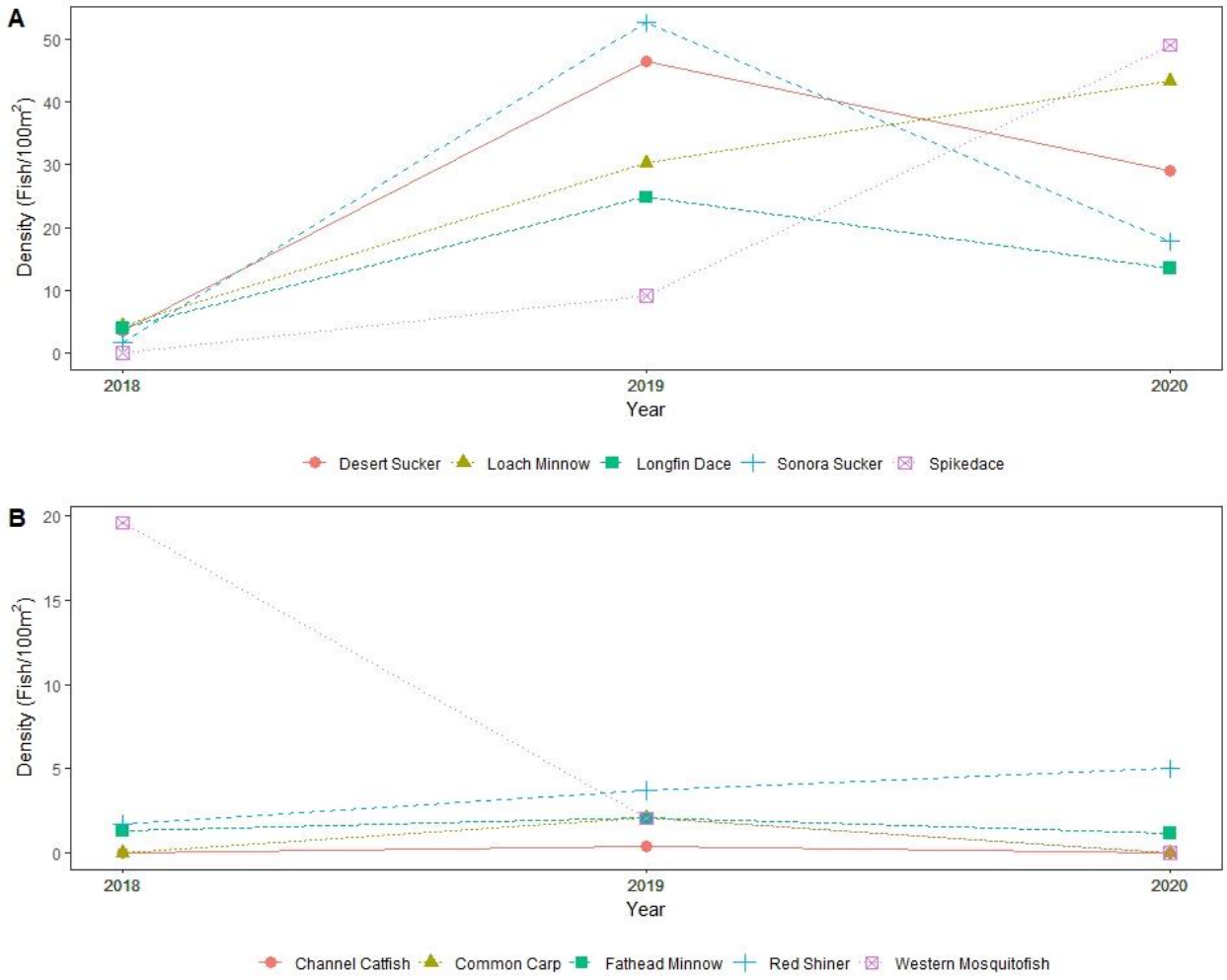

Figure 11. Density of native fishes (A) and nonnative fishes (B) at Gila River Cherokee Canyon site in 2018, 2019, and 2020.

Table 17. Number captured, relative species abundance, and density for each species captured at the Gila River Cherokee Canyon site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Fathead Minnow	3	0.73	1.16
Desert Sucker	75	18.25	28.95
Loach Minnow	112	27.25	43.24
Longfin Dace	35	8.52	13.51
Red Shiner	13	3.16	5.02
Sonora Sucker	46	11.19	17.76
Spikedace	127	30.90	49.03

Table 18. Area sampled, habitat composition, depth (mean ± SE, if n>1), velocity (mean ± SE, if n>1) of all habitat types sampled within the Gila River Cherokee Canyon site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Chute	15.8	6.1	0.41	0.34
Eddy	15.2	5.9	0.37	-0.04
Pool	29.0	11.2	0.42	0.16
Riffle	94.0	36.3	0.16±0.02	0.46±0.04
Run	29.7	11.5	0.30	0.21
Shoal	29.7	11.5	0.19	0.25
Shoreline Pool	33	12.7	0.51	0.12
Shoreline Run	12.6	4.9	0.26	0.18

Gila River—Iron Bridge

The Iron Bridge site on the Gila River is one of the original permanent monitoring sites where sampling began in 1988. All native fish species are consistently captured at the site, with the exception of Roundtail Chub (Table 18). Desert Sucker is the only species that has been collected in all years. Sonora Sucker were the most abundant species collected in 2020 (Table 19). Densities of most native fishes declined compared to 2019 (Figure 12). Shoreline run made up most of the habitat sampled (Table 20).

Table 18. Occurrence of fishes at the Gila River Iron Bridge site, Grant County, New Mexico, 1988-2020. X indicates species presence.

		Year																																
	Species	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																																		
	Desert Sucker	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Loach Minnow	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Longfin Dace	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Roundtail Chub				X																													
	Sonora Sucker	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Spikedace	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X				X	X	X	X	X	X
Nonative																																		
	Black Bullhead												X																					
	Channel Catfish	X																																
	Common Carp				X			X																				X						
	Fathead Minnow											X	X							X								X						X
	Flathead Catfish	X			X							X										X									X		
	Green Sunfish		X		X																			X						X			
	Largemouth Bass			X	X	X																												
	Red Shiner			X			X		X	X		X	X			X	X			X	X			X	X			X						X
	Smallmouth Bass		X		X	X												X				X				X								
	Western Mosquitofish	X	X	X	X	X	X	X				X	X		X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X
	Yellow Bullhead												X																					

NO MONITORING

Table 19. Number captured, relative species abundance and density for each species captured at the Gila River Iron Bridge site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Desert Sucker	189	27.92	38.20
Fathead Minnow	3	0.44	0.61
Loach Minnow	133	19.65	26.88
Longfin Dace	23	3.40	4.65
Red Shiner	4	0.59	0.81
Sonora Sucker	269	39.73	54.36
Spikedace	22	3.25	4.45
Western Mosquitofish	34	5.02	6.87

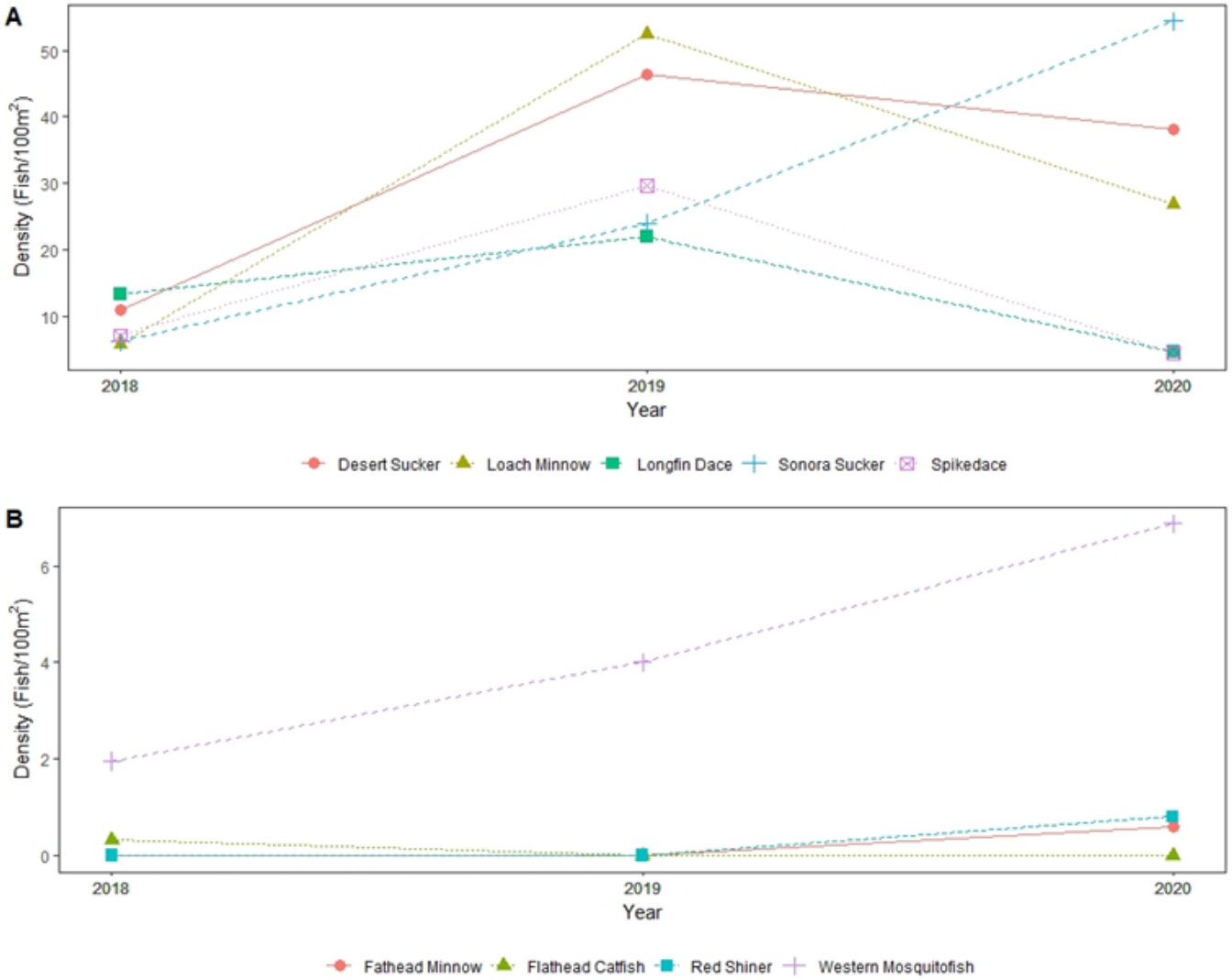

Figure 12. Density of native fishes (A) and nonnative fishes (B) at Gila River Iron Bridge site in 2018, 2019, and 2020.

Table 20. Area sampled, habitat composition, depth (mean ± SE, if n>1), and velocity (mean ± SE, if n>1) of all habitat types sampled within the Gila River Iron Bridge site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Riffle	50	10.1	0.21±0.03	0.64±0.13
Shoreline Run	445	89.9	0.35±0.02	0.18±0.07

Gila River—Sunset Diversion

Sunset Diversion is the newest permanent monitoring site, with sampling beginning in 2010. The Gila River Sunset Diversion was selected as a replacement for the Fisherman's Overlook site due to limited accessibility. Data from the Sunset Diversion and Fisherman's Overlook sites have not been combined due to differences between habitats at each site caused by the diversion. Only three native fish species have been collected at the site since 2010 (Table 20). No water was flowing over the diversion in 2020, and habitat below the diversion was maintained only by seepage through the diversion. The only species captured was nonnative Western Mosquitofish (Table 21). Aside from Western Mosquitofish, only low densities of fishes have been captured at the site since 2018 (Figure 13). Run habitat below the diversion made up 43% of the habitat sampled (Table 22).

Table 20. Occurrence of fishes at Gila River Sunset Diversion site, Hidalgo County, New Mexico, 2010-2020. X indicates species presence.

		Year										
	Species	10	11	12	13	14	15	16	17	18	19	20
Native							NO MONITORING					
	Desert Sucker		X			X		X	X		X	
	Longfin Dace		X			X		X	X	X	X	
	Sonora Sucker								X			
Nonnative												
	Channel Catfish	X	X	X		X		X	X	X		
	Common Carp					X		X				
	Fathead Minnow					X		X	X		X	
	Flathead Catfish					X		X	X			
	Red Shiner	X	X			X		X	X	X	X	
	Western Mosquitofish		X		X			X	X		X	X

Table 21. Number captured, relative species abundance, and density for each species captured at the Gila River Sunset Diversion site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100m^2)
Western Mosquitofish	24	100	6.52

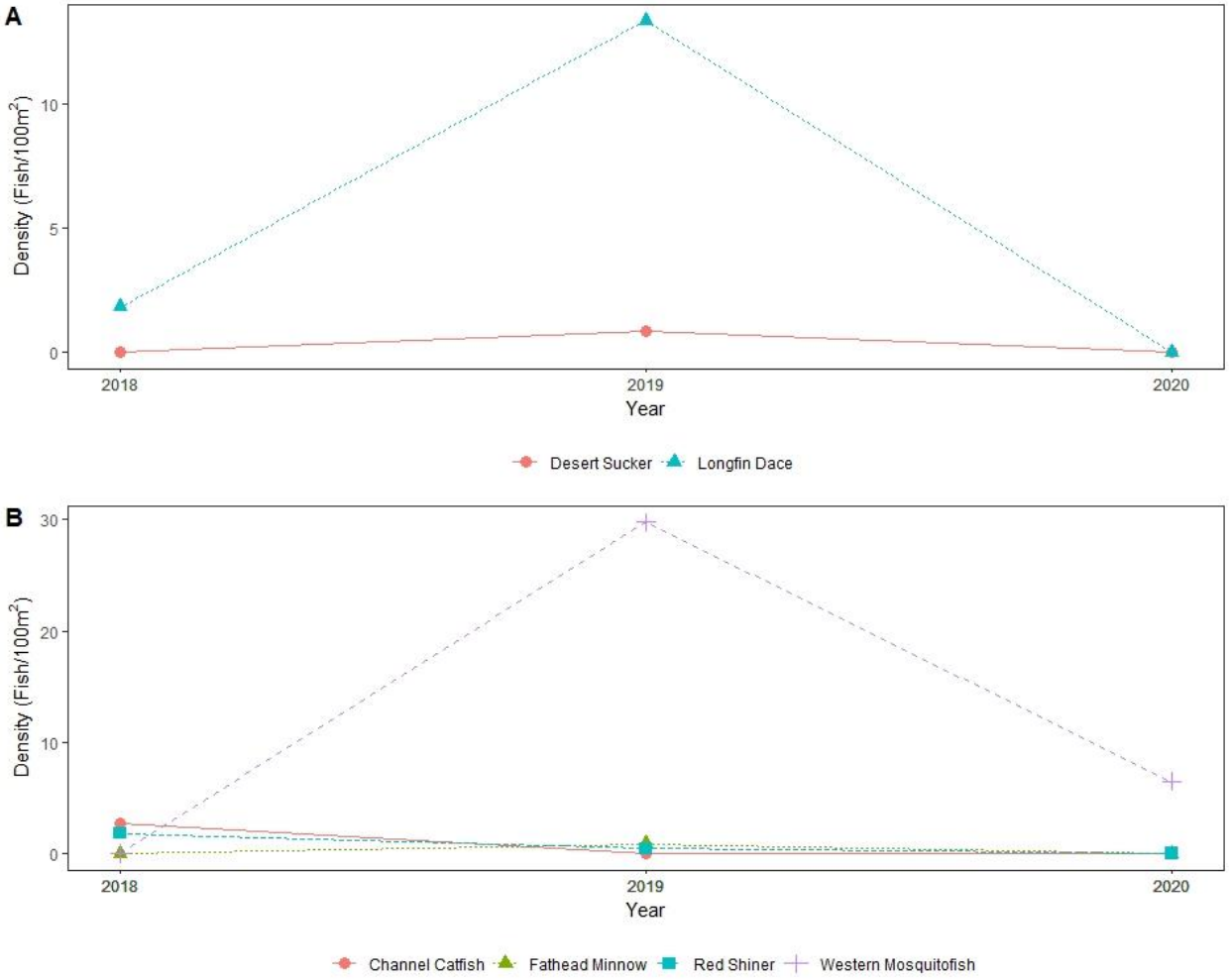

Figure 13. Density of native fishes (A) and nonnative fishes (B) at Gila River Sunset Diversion site in 2018, 2019, and 2020.

Table 22. Area sampled, habitat composition, depth (mean ± SE, if n>1), and velocity (mean ± SE, if n>1) of all habitat types sampled within the Gila River Sunset Diversion site in 2019.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Pool	150	40.7	0.23±0.05	0.04±0.01
Run	159	43.3	0.09±0.00	0.09±0.02
Shoal	32	8.7	0.12	0.03
Shoreline Run	27	7.3	0.22	0.02

Middle Fork Gila River—Trailhead

The Trailhead site on the Middle Fork Gila River is an original permanent site where sampling began in 1988. High densities of nonnatives were common at this site until 2012 when the Whitewater Baldy Fire burned large areas of the Middle Fork Watershed. Ash flows, silt and debris affected the site during the monsoon seasons of 2012 and 2013. The 2012 sampling had the fewest fish collected since sampling began, followed by a small recovery of native species in 2013. In 2014 and 2015, the diversity of native fish species remained high, but Yellow Bullhead was the second most common species. In 2017, all native fish species were documented in the same year for the first time since 1995. Spikedace have not been captured since 2017 and Loach Minnow were not captured for the second consecutive year in 2020 (Table 23). Smallmouth Bass was the most abundant species in 2020 (Table 24). Most native fish densities have declined compared to 2019 (Figure 14). Pool habitat was the most common habitat sampled within the site (Table 25).

Table 23. Occurrence of fishes at Middle Fork Gila River Trailhead site, Catron County, New Mexico, 1988-2020. X indicates species presence.

		Year																															
	Species	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																																		
	Desert Sucker	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
	Loach Minnow	X	X	X	X	X	X	X	X	X	X	X															X	X	X	X	X	X		
	Longfin Dace	X	X	X	X	X	X	X	X		X											X	X	X			X	X	X	X	X	X		X
	Roundtail Chub	X	X	X	X	X	X	X	X	X	X	X	X		X	X					X	X	X		X		X				X		X	
	Sonora Sucker	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Speckled Dace	X	X	X	X	X	X	X	X			X										X		X	X		X	X	X	X	X			
	Spikedace	X	X	X		X	X		X												X	X		X				X	X	X	X			
Nonnative																																		
	Bluegill					X																												
	Brown Trout	X	X	X			X														X	X	X	X										
	Common Carp																							X	X			X		X			X	
	Fathead Minnow	X			X		X																	X	X				X					
	Flathead Catfish																									X								
	Green Sunfish					X					X							X			X			X	X									
	Rainbow Trout		X				X					X	X	X								X	X						X				X	
	Red Shiner																						X											
	Smallmouth Bass	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X			X	X
	Western Mosquitofish		X			X		X		X		X	X	X	X	X	X					X	X	X	X			X	X	X				
	Yellow Bullhead	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X

Table 24. Number captured, relative species abundance, and density for each species captured at the Middle Fork Gila River Trailhead site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Desert Sucker	4	7.55	0.94
Longfin Dace	1	1.89	0.23
Sonora Sucker	15	28.30	3.52
Smallmouth Bass	17	32.08	3.99
Yellow Bullhead	16	30.19	3.75

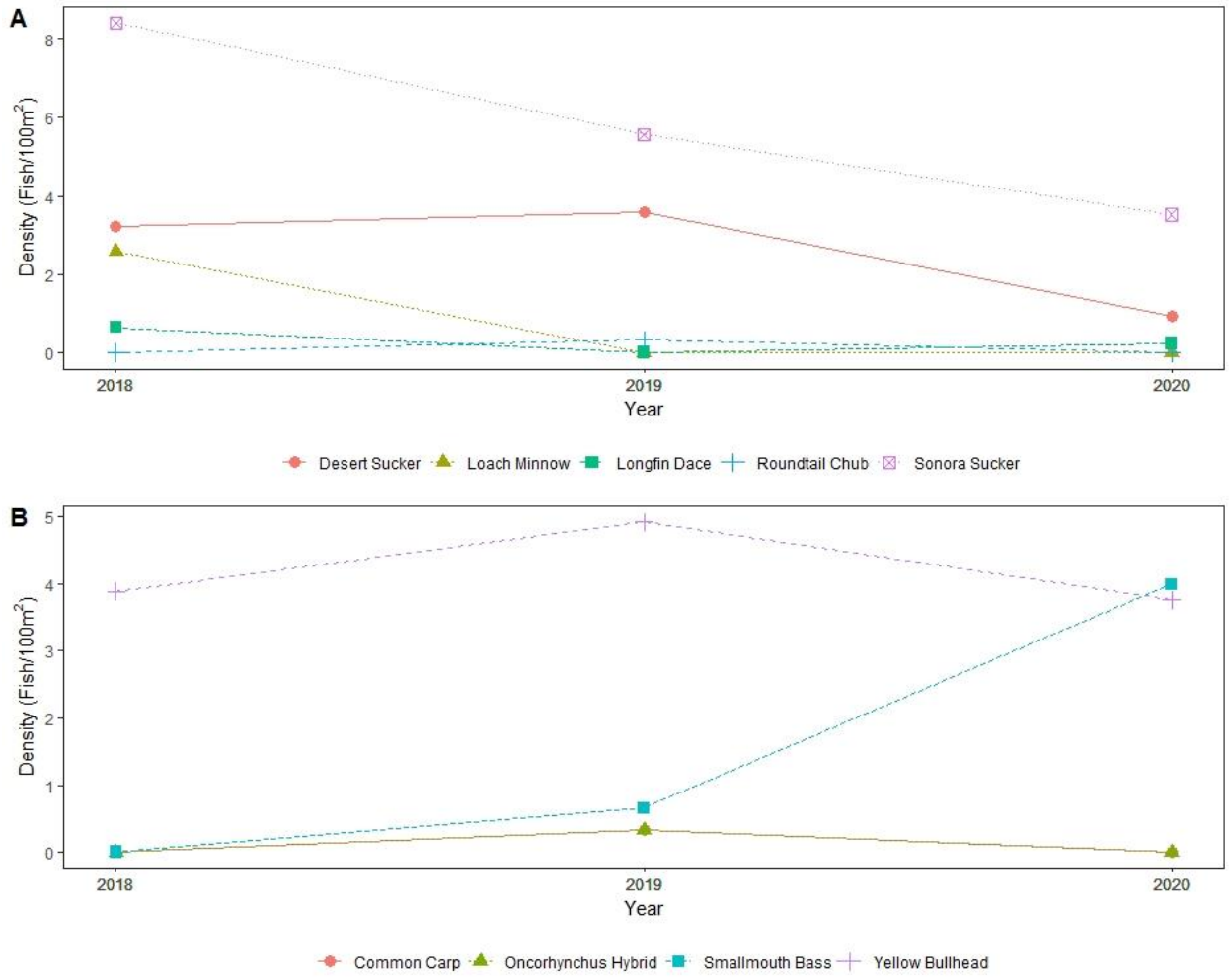

Figure 14. Density of native fishes (A) and nonnative fishes (B) at Middle Fork Gila River Trailhead site in 2018, 2019, and 2020.

Table 25. Area sampled, habitat composition, depth (mean ± SE, if n>1), and velocity (mean ± SE, if n>1) of all habitat types sampled within the Middle Fork Gila River Trailhead site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Pool	236	55.3	0.70±0.06	0.15±0.03
Riffle	71	16.7	0.20±0.00	0.46±0.02
Run	73	17.1	0.30±0.00	0.27±0.03
Shoreline Run	46	10.9	0.21	0.36

San Francisco River—Glenwood Ranger Station

The Glenwood Ranger Station site on the San Francisco River has been a permanent site since 1988. The site was impacted by ash flows as a result of the Whitewater-Baldy Fire in the spring of 2012 and no fish were collected in 2012. One Fathead Minnow *Pimephales promelas* was collected in 2013. Desert Sucker, Sonora Sucker, and Longfin Dace had recolonized the site by 2014, and in 2015 all native fish species that were present before the fire were collected. In 2017, Spikedace were recorded in the San Francisco River for the first time since 1950. Spikedace reintroduction efforts have been ongoing since 2008 with funding from the GRBNFCP. Spikedace were stocked in the San Francisco River approximately 15 miles upstream of the permanent site location. Spikedace were captured again at the site in 2019 and 2020. In 2020, Smallmouth Bass were captured at the site for the first time (Table 26). Captured Smallmouth Bass were young-of-year fish, each under 80 mm total length. We have no recent records of Smallmouth Bass in the San Francisco River in New Mexico. Native Catostomids were the most abundant species in 2020 (Table 27). Densities of most species have increased since 2018 (Figure 15). Shoreline pool habitat made up 29.1% of the habitat sampled within the site (Table 28).

Table 26. Occurrence of fishes at San Francisco River Glenwood Ranger Station site, Catron County, New Mexico, 1988-2020. X indicates species presence.

		Year																																
	Species	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																																		
	Desert Sucker	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	Loach Minnow	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X
	Longfin Dace	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X		X	X	X	X	X			X	X	X	X	X	X	X
	Sonora Sucker	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X	X		X	X	X	X
	Speckled Dace	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X
	Spikedace																														X		X	X
Nonnative																																		
	Fathead Minnow	X	X						X												X		X				X	X	X	X				
	Largemouth Bass				X		X																											
	Rainbow Trout			X	X	X		X				X	X		X													X						
	Smallmouth Bass																																	X
	Western Mosquitofish	X		X				X					X				X																	X

NO MONITORING

Table 27. Number captured, relative species abundance and density for each species captured at the San Francisco River Glenwood Ranger Station site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Desert Sucker	268	46.53	122.72
Loach Minnow	19	3.30	8.70
Longfin Dace	97	16.84	44.42
Smallmouth Bass	2	0.35	0.92
Sonora Sucker	108	18.75	49.45
Speckled Dace	32	5.56	14.65
Spikedace	46	7.99	21.06
Western Mosquitofish	4	0.69	1.83

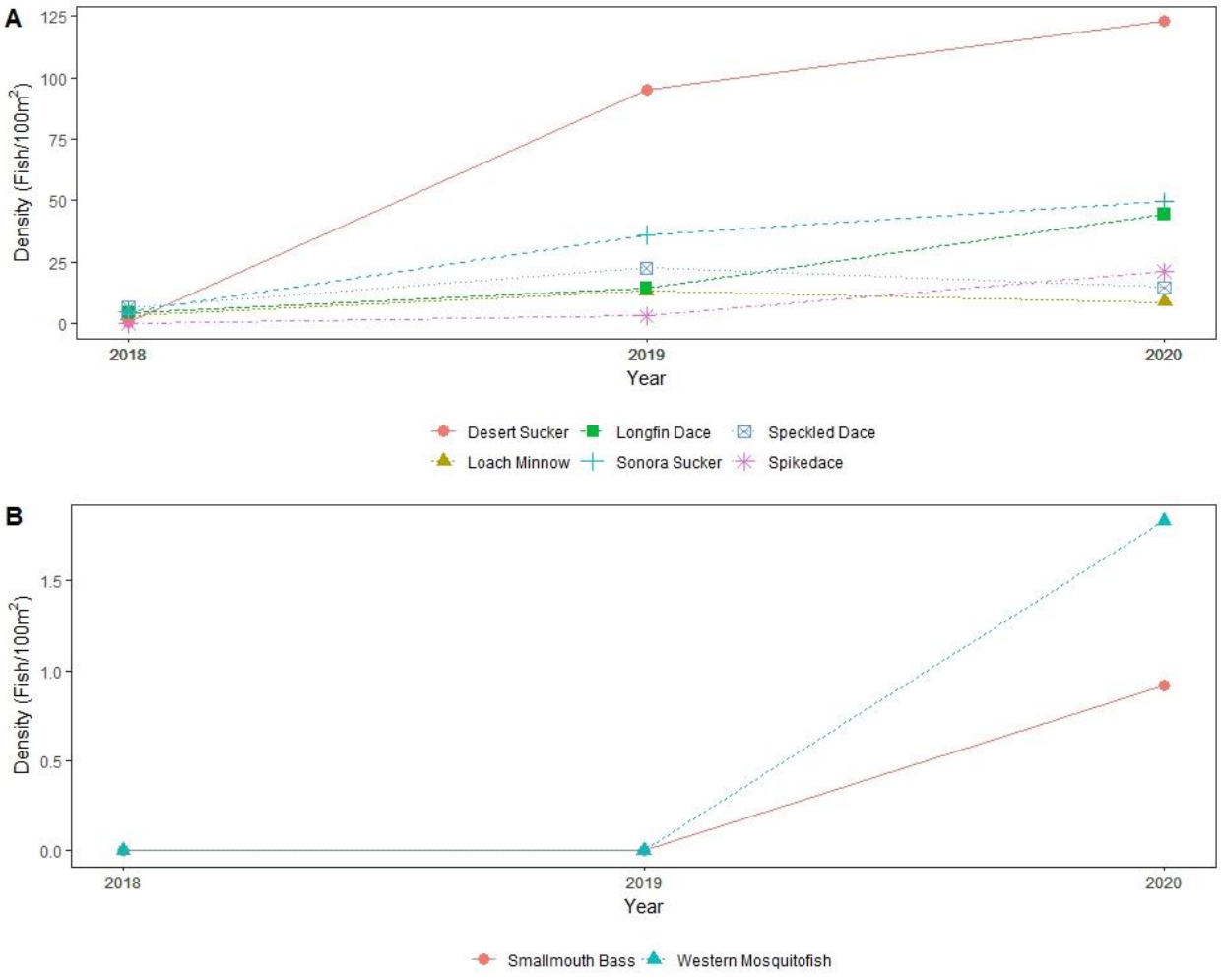

Figure 15. Density of native fishes (A) and nonnative fishes (B) at San Francisco River Glenwood Ranger Station site in 2018, 2019, and 2020.

Table 28. Area sampled, habitat composition, depth (mean ± SE, if n>1), and velocity (mean ± SE, if n>1) of all habitat types sampled within the San Francisco River Glenwood Ranger Station site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Backwater	21	9.6	0.38	0
Pool	31	14.0	0.87	0.25
Riffle	54	24.9	0.18±0.08	0.78±0.08
Shoreline Pool	63	29.1	0.63	0.12
Shoreline Run	49	22.4	0.24±0.12	0.34±0.16

Tularosa River—Eagle Peak Road

The Eagle Peak Road site on the Tularosa River has been sampled since 1988. In that time, 10 fish species have been collected (Table 29). Only 8 fish were captured in 2018 compared to 666 in 2017. The Buzzard Fire burned within the watershed in June 2018 and it is possible increased flood flows and ash/sediment affected fish populations throughout the Tularosa River. All expected native species were found and no nonnatives were captured in 2020. The most abundant species was Longfin Dace (Table 30). Density of fish increased in 2020 when compared to 2018 and 2019 (Figure 16), indicating recovery from the effects of the Buzzard Fire. Habitat sampled consisted of mostly runs (Table 31).

Table 29. Occurrence of fishes at Tularosa River Eagle Peak Road site, Catron County, New Mexico, 1988-2020.

		Year																															
	Species	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																																		
	Desert Sucker	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Loach Minnow	X	X	X	X	X	X	X	X	X	X	X	X		X	X						X		X					X		X	X		X
	Longfin Dace	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Sonora Sucker	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Speckled Dace	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Nonnative																																		
	Brook Stickleback															X								X		X	X							
	Fathead Minnow					X				X	X					X					X			X	X	X	X	X	X	X				
	Green Sunfish																									X				X				
	Rainbow Trout										X																							
	Western Mosquitofish		X		X	X		X		X				X	X	X	X	X			X		X	X		X				X				

Table 30. Number captured, relative species abundance, and density for each species captured at the Tularosa River Eagle Peak Road site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Desert Sucker	81	18.12	45.69
Loach Minnow	1	0.22	0.56
Longfin Dace	202	45.19	113.95
Sonora Sucker	123	27.52	69.39
Speckled Dace	40	8.95	22.57

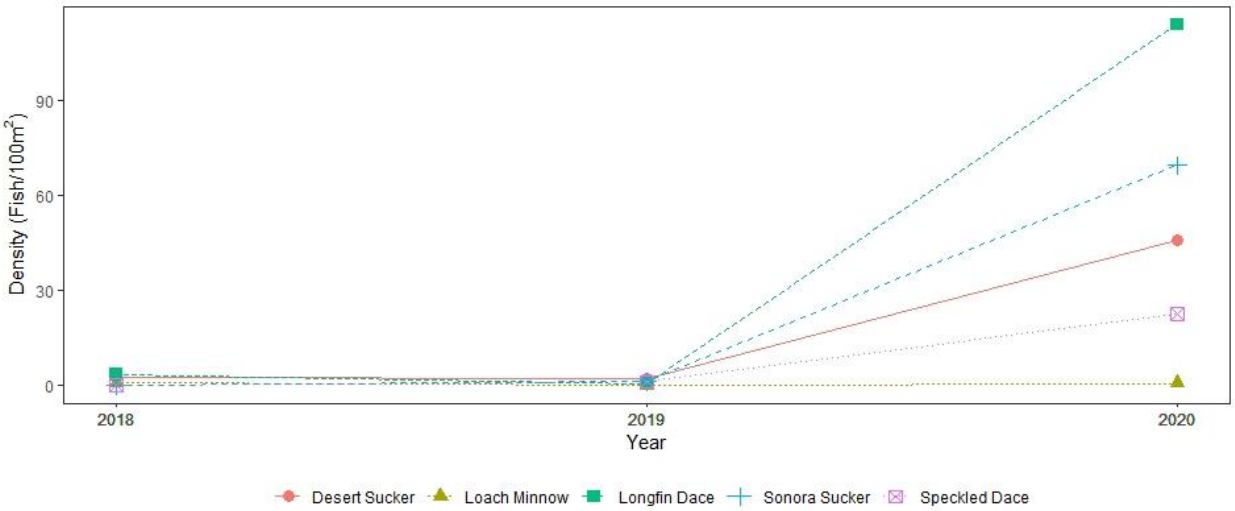

Figure 16. Density of fish by species at Tularosa River Eagle Peak Road site in 2018, 2019, and 2020.

Table 31. Area sampled, habitat composition, depth (mean ± SE, if n>1), and velocity (mean ± SE, if n>1) of all habitat types sampled within the Tularosa River Eagle Peak Road site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Pool	2	1.2	0.40	0.27
Riffle	43	24.4	0.18±0.00	0.45±0.03
Run	132	74.4	0.20±0.04	0.28±0.03

West Fork Gila River—Gila Cliff Dwellings

The Gila Cliff Dwellings site on the West Fork Gila River was added as a permanent site in 1989. From 2001 through 2003, and during 2011 and 2012, wildfires (i.e., Cub, Dry Lakes, Miller and Whitewater-Baldy) burned portions of the West Fork Gila River Drainage. Ash flows, caused by intense summer storms and spring snowmelt, had potentially negative effects on fishes in the West Fork Gila River. In 2014, Loach Minnow were collected for the first time since 2001 and have been collected annually since (Table 32). One Gila Trout was collected in 2019, the first Gila Trout ever collected at the site. More Gila Trout were captured in 2020 and Speckled Dace was the most abundant species collected (Table 33). Nonnative fishes continue to be present at low densities (Figure 17). Shoreline Run habitat was 46.3% of the habitat sampled within the site (Table 34).

Table 32. Occurrence of fishes at West Fork Gila River Cliff Dwellings site, Catron County, New Mexico, 1989-2020. X indicates species presence.

		Year																														
	Species	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Native																																	
	Desert Sucker	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Gila Trout																														X	X	
	Loach Minnow	X	X	X	X	X	X	X	X	X	X	X		X													X	X	X	X	X	X	X
	Longfin Dace	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Roundtail Chub			X	X			X				X		X		X	X	X	X		X		X							X			
	Sonora Sucker	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	Speckled Dace	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Spikedace	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	X	X	X	X
Nonnative																																	
	Brown Trout				X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X									
	Rainbow Trout	X	X	X	X	X	X	X	X	X	X	X		X			X			X	X	X								X	X	X
	Smallmouth Bass	X		X	X	X				X							X	X													X	X
	Western Mosquitofish			X	X								X																			
	Yellow Bullhead		X					X	X	X															X								

Table 33. Number captured, relative species abundance, and density for each species captured at the West Fork Gila River Gila Cliff Dwellings site in 2020.

Species	Number Captured	Relative Species Abundance (%)	Density (fish/100 m^2)
Desert Sucker	93	34.96	29.50
Gila Trout	6	2.26	1.90
Loach Minnow	4	1.50	1.27
Longfin Dace	2	0.75	0.63
Rainbow Trout	4	2.63	1.27
Smallmouth Bass	1	0.38	3.17
Sonora Sucker	34	12.78	10.79
Speckled Dace	112	42.11	35.53
Spikedace	10	3.76	3.17

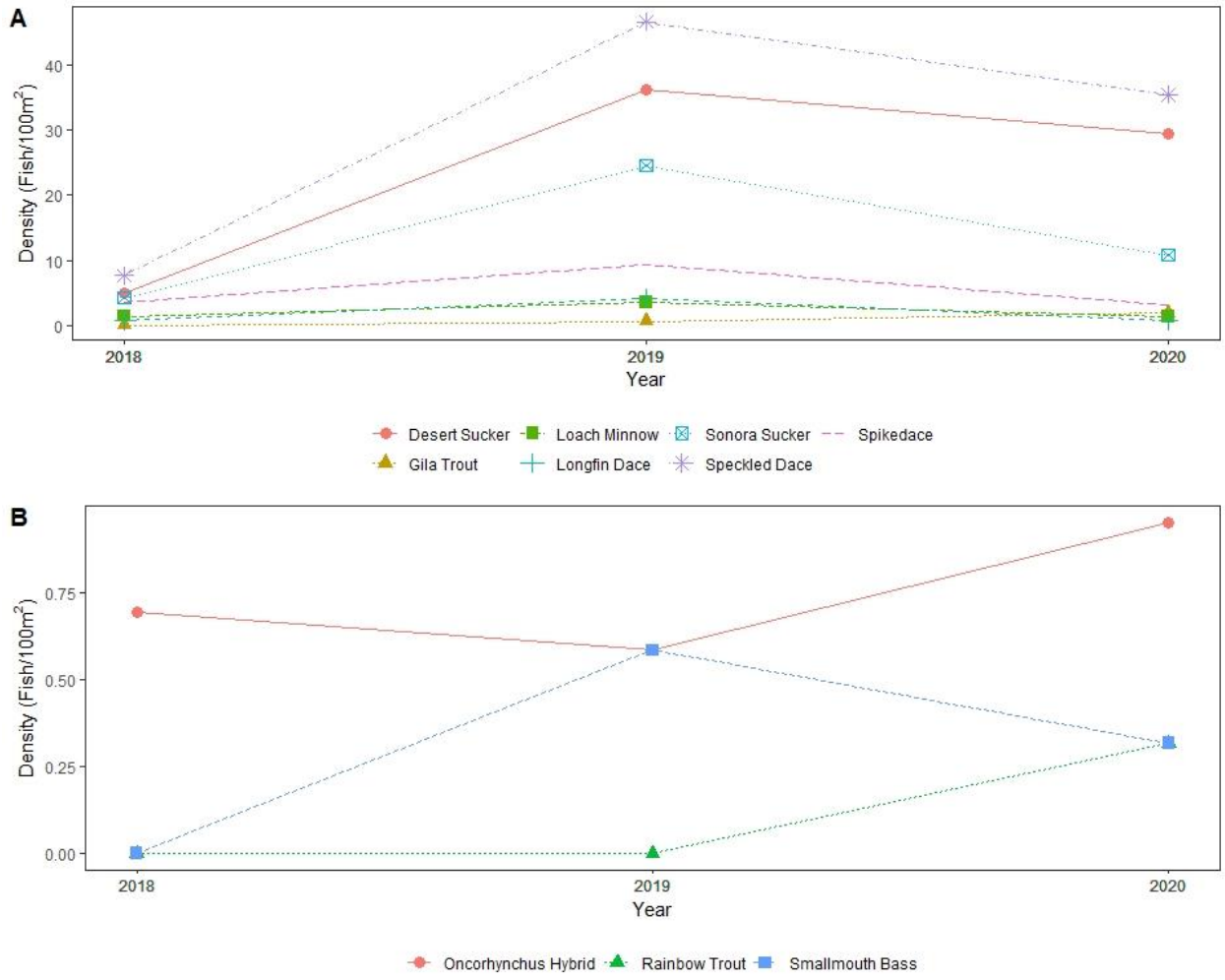

Figure 17. Density of native fishes (A) and nonnative fishes (B) at West Fork Gila River site in 2018, 2019, and 2020.

Table 34. Area sampled, habitat composition, depth (mean ± SE, if n>1), and velocity (mean ± SE, if n>1) of all habitat types sampled within the West Fork Gila River Cliff Dwellings site in 2020.

Habitat Type	Area Sampled (m^2)	Composition (%)	Depth (m)	Velocity (m/s)
Pool	57	18.2	0.52	0.08
Riffle	58	18.5	0.15±0.01	0.53±0.09
Run	54	17.0	0.14	0.35
Shoreline Run	146	46.3	0.45	0.08

Recommendations

- The permanent site long term dataset is essential to track changes in presence and density of native fishes in the Gila River Basin and should be continued annually.

Work Planned for 2021

- Survey a minimum of 9 permanent sites in the Gila River Basin in New Mexico in October.

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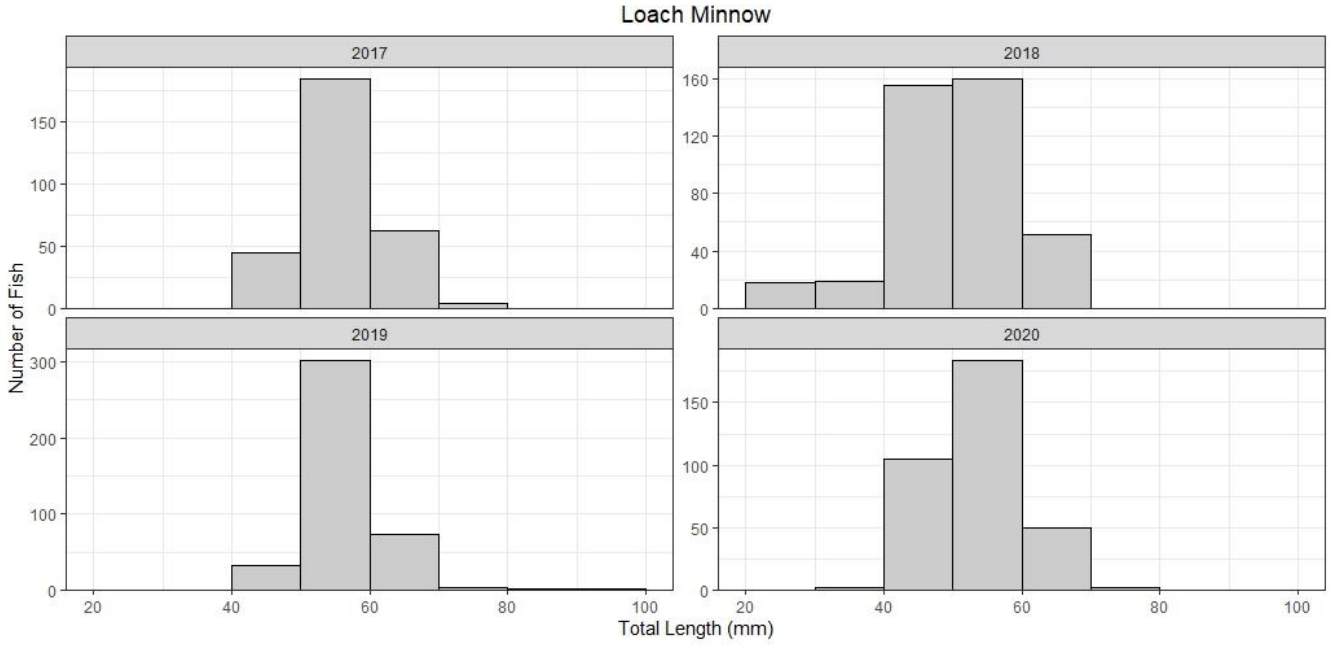
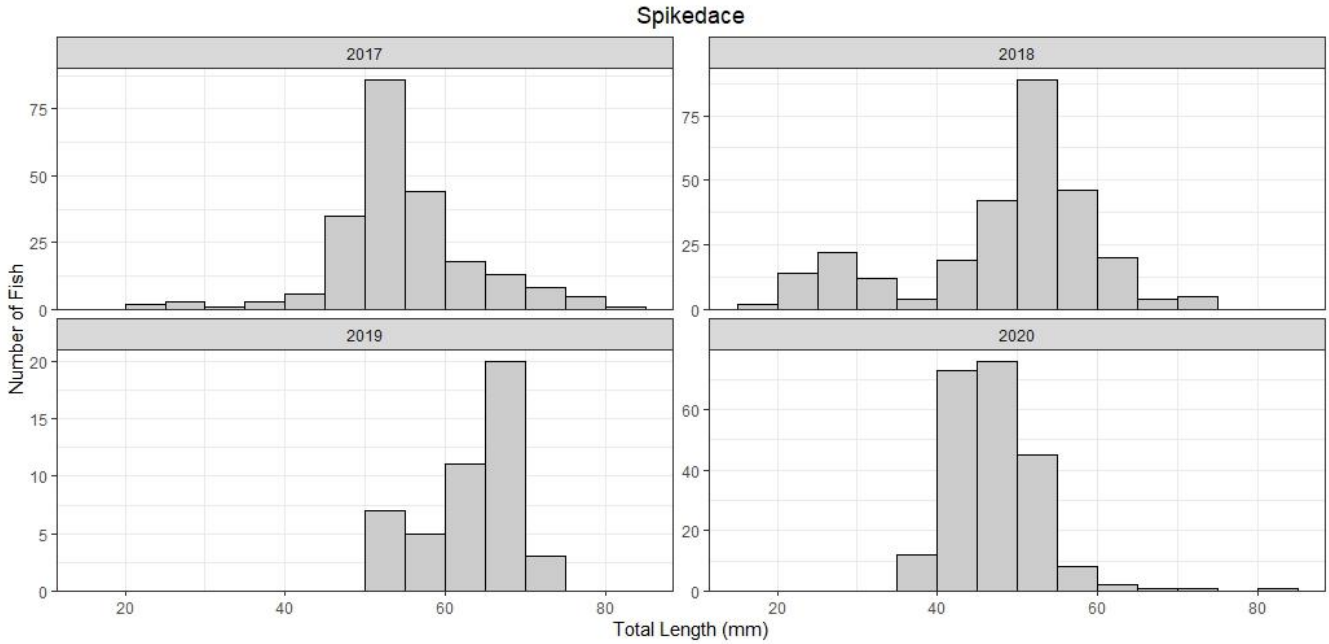
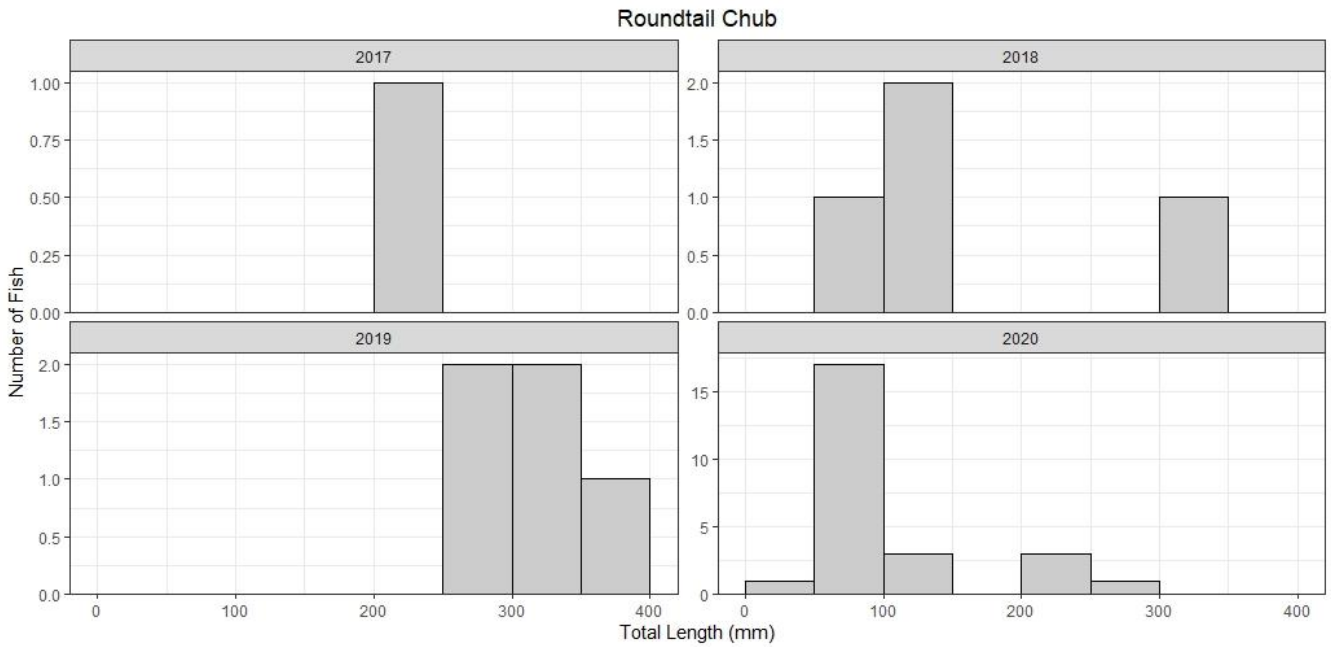
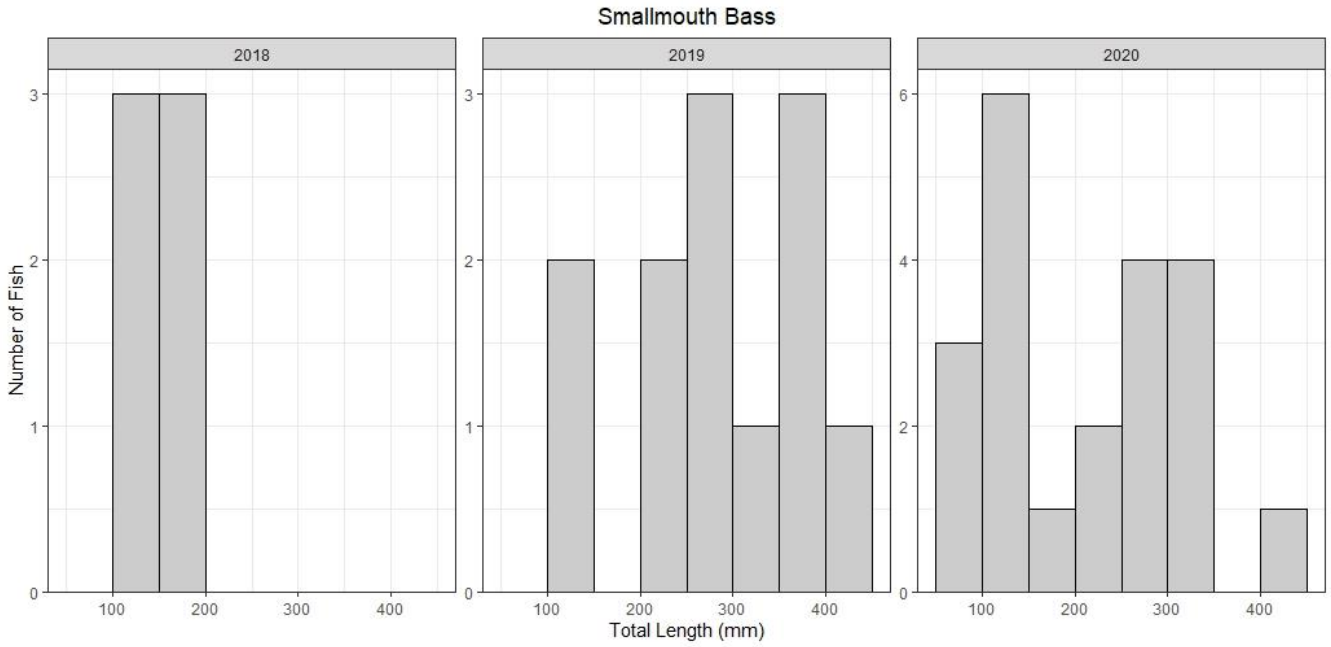
Appendix A.

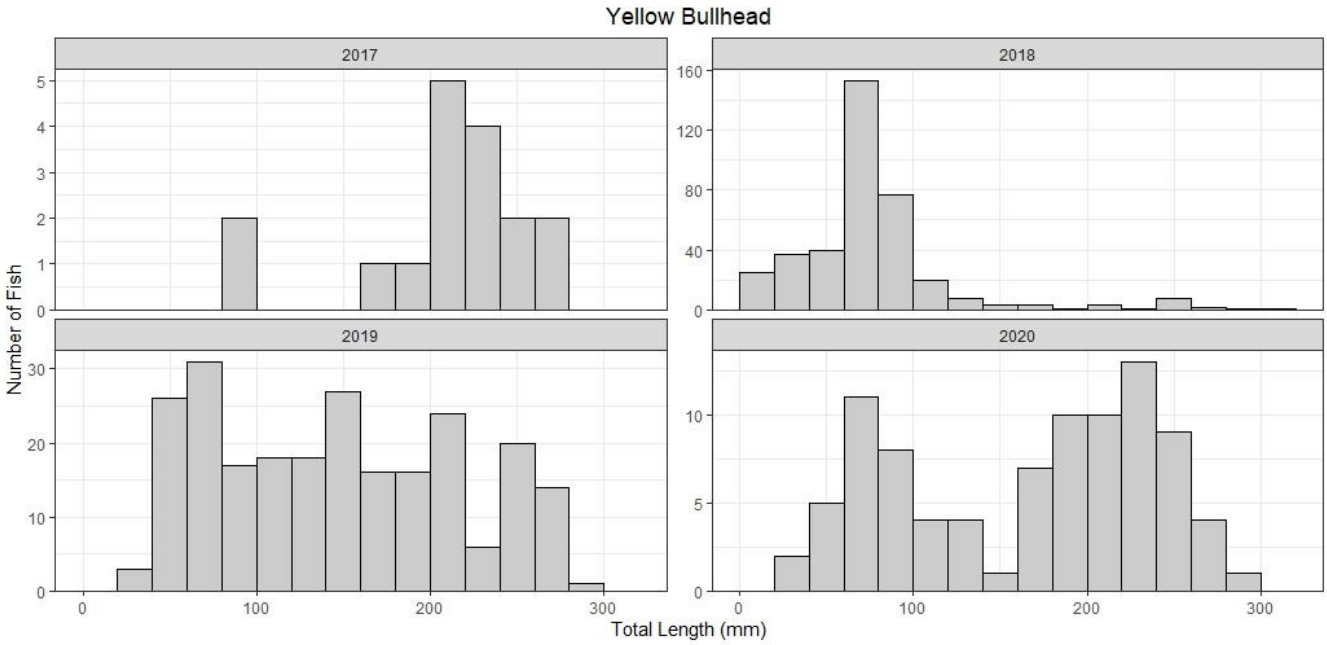
Length frequency of selected species collected during the nonnative removal on the West Fork Gila River from 2017 to 2020. No Smallmouth Bass were captured in 2017 and not all individuals were measured. Bin sizes differ for each species: Loach Minnow bin= 10 mm, Roundtail Chub bin = 50 mm, Smallmouth Bass bin= 50 mm, Spikedace bin= 5 mm, Yellow Bullhead bin= 20 mm.






Roundtail Chub
2017
2018
2019
2020
Number of Fish
Total Length (mm)


Smallmouth Bass
2018
2019
2020
Number of Fish
Total Length (mm)


Yellow Bullhead
2017
2018
2019
2020
Number of Fish
Total Length (mm)
0
1
2
3
4
5
40
80
120
160
10
20
30
100
200
300