

Gila River Basin Native Fishes Conservation Program:  
Arizona Game and Fish Department's Native Fish Conservation Efforts During 2016  
And  
2017 Work Plan

Cooperative Agreement R16AC00077  
Between Bureau of Reclamation and Arizona Game and Fish Department  
Annual Report

August 21, 2017

Anthony Robinson, Kent Mosher, and Kaleb Smith  
Arizona Game and Fish Department  
5000 W. Carefree Highway  
Phoenix, AZ 85086



*Program  
Cooperators:*



### ***Arizona Game and Fish Department Mission***

To conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs, and to provide wildlife resources and safe watercraft and off-highway vehicle recreation for the enjoyment, appreciation, and use by present and future generations.

### ***Civil Rights and Diversity Compliance***

*The Arizona Game and Fish Department prohibits discrimination on the basis of race, color, sex, national origin, age, or disability in its programs and activities. If anyone believes they have been discriminated against in any of AGFD's programs or activities, including its employment practices, the individual may file a complaint alleging discrimination directly with AGFD Deputy Director, 5000 W. Carefree Highway, Phoenix, AZ 85086, (623) 236-7290 or U.S. Fish and Wildlife Service, 4040 N. Fairfax Dr., Ste. 130, Arlington, VA 22203.*

### ***Americans with Disabilities Act Compliance***

*Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, or this document in an alternative format, by contacting the AGFD Deputy Director, 5000 W. Carefree Highway, Phoenix, AZ 85086, (623) 236-7290, or by calling TTY at 1-800-367-8939. Requests should be made as early as possible to allow sufficient time to arrange for accommodation.*

### **Acknowledgements**

The work described in this report was funded through Cooperative Agreement (No. R16AC00077) with the U.S. Bureau of Reclamation as part of the Central Arizona Project (CAP) Gila River Basin Native Fishes Conservation Program. Individuals that participated in monitoring, removal, and stocking activities are too numerous to list, however we could not have completed the work without their participation and involvement.

### **Recommended Citation:**

Robinson, A. T., K. Mosher, and K. Smith. 2017. Gila River Basin Native Fishes Conservation Program: Arizona Game and Fish Department's native fish conservation efforts during 2016 and 2017 work plan. An Arizona Game and Fish Department Annual Report for Cooperative Agreement No. R16AC00077 submitted to U.S. Bureau of Reclamation, Phoenix Area Office. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix.

**Table of Contents**

OVERVIEW ..... 1

PERFORMANCE MEASURES..... 2

GENERAL ACTIVITIES ..... 3

PRIORITY ACTIONS..... 4

Acquire Spikedace, Loach Minnow and rare populations of other native fish..... 4

Muleshoe ecosystem stream and spring repatriations..... 5

Fossil Creek repatriations ..... 8

Fresno Canyon repatriations ..... 9

Bonita Creek renovation and repatriations ..... 10

Arizona trout stream Loach Minnow repatriations..... 12

Gila Topminnow stockings..... 13

Arnett Creek repatriations..... 31

Spring Creek (Oak Creek tributary) repatriations..... 32

Mineral Creek drainage renovation and repatriations..... 34

Blue River native fish restoration ..... 35

Miscellaneous stock tank surveys..... 38

Assess potential repatriation waters..... 39

Aquatic Research and Conservation Center O&M..... 51

Transfer Roundtail Chub and Gila Topminnow to New Mexico ..... 53

Sands Draw repatriations ..... 54

Fish health assessments of translocation populations..... 55

Post-repatriation evaluations..... 56

Red Tank Draw native fish restoration ..... 56

Sharp Spring native fish restoration..... 59

2017 WORK PLAN SCHEDULE ..... 60

LITERATURE CITED ..... 62

TABLES ..... 66

FIGURES ..... 76

APPENDIXES ..... 90

## OVERVIEW

The Gila River Basin Native Fishes Conservation Program (Program; previously known as the Central Arizona Project [CAP] Fund Transfer Program) was developed to minimize impacts of the CAP on threatened and endangered native fishes of the Gila River basin. The U.S. Fish and Wildlife Service (USFWS) concluded in a 1994 biological opinion that the CAP would be a conduit for transfers of nonnative fishes and other aquatic organisms from the lower Colorado River (where the CAP originates) to waters of the Gila River basin. That opinion identified the spread and establishment of nonnative aquatic organisms as a serious long-term threat to the status and recovery of native aquatic species, following a long history of habitat loss and degradation. Impacts of nonnatives include predation, competition, hybridization, and parasite and pathogen transmission.

The 1994 USFWS opinion concluded that operation of the CAP would jeopardize the continued existence of four native threatened or endangered fish species: Gila Topminnow *Poeciliopsis occidentalis*, Spikedace *Meda fulgida*, Loach minnow *Rhinichthys cobitis*, and Razorback Sucker *Xyrauchen texanus*. The Service also concluded that the CAP would adversely modify designated critical habitat of Spikedace, Loach Minnow, and Razorback Sucker. Five reasonable and prudent alternatives were specified: 1) construction and operation of barriers prevent the spread of nonnative fishes from the CAP to native fish habitats, 2) monitoring of nonnative fish, 3) transfer of funds to USFWS to recover natives, 4) transfer of funds to USFWS to manage nonnatives and research to support that management, and 5) inform and educate the public about nonnative fishes. The transfer of funds under reasonable and prudent alternatives 3 and 4 became known as the CAP Funds Transfer Program. In a 2001 revision of the 1994 opinion, the reasonable and prudent alternatives became conservation measures, and the Santa Cruz River drainage was added to its geographic scope. In a 2008 revision, the newly-listed endangered Gila Chub *Gila intermedia* and Chiricahua Leopard Frog *Lithobates chiricahuensis* were added to the Program as species affected by operation of the CAP.

The Program is funded by the U.S. Bureau of Reclamation (Reclamation), and is directed by the U.S. Fish and Wildlife Service (Service) and Reclamation, in cooperation with the New Mexico Department of Game and Fish (NMDGF) and Arizona Game and Fish Department (Department). The Program mission is to undertake and support conservation actions (recovery and protection) for federal/state-listed or candidate fish species native to the Gila River basin by implementing existing and future recovery plans for those fishes. There are finalized recovery plans for four of the five priority species, and a draft recovery plan for the Gila Chub (U.S. Fish and Wildlife Service, 1983, 1990, 1991, 2002, 2015).

This report summarizes Program work performed by the Department during 2016 and presents the 2017 Work Plan. For each priority action, work completed during 2016 is presented,

followed by recommendations and planned work for 2017. An overall schedule of work planned for 2017 is presented in the final section of the report.

Reclamation began taking over administration of the Program from USFWS in 2015. During the early part of 2016, the Department was operating under an agreement with USFWS to complete Program tasks. The Department ran out of USFWS funding for Program projects in March 2016. The Department and Reclamation began developing a new agreement late in 2015, but it did not get finalized until August 2016 (R16AC00077). Therefore, because funding was not in place, the Department did not perform any Program tasks during from April 1 to the end of June 2016. The Department resumed Program work on June 20, 2016 because they became confident that the new agreement would soon be finalized and Reclamation indicated that they could charge prior work to the agreement.

In September 2016, the American Fisheries Society and the American Society of Ichthyologists and Herpetologists reclassified and merged Roundtail Chub *Gila robusta*, Gila Chub *Gila intermedia*, and Headwater Chub *Gila nigra* into one species, the Roundtail Chub. Arizona Game and Fish Department recognizes these changes, and all populations formerly recognized and referred to as Headwater Chub or Gila Chub (sensu Minckley and DeMarais, 2000) are reported herein as Roundtail Chub, *Gila robusta*. To maintain consistency with previous reports, chub in locations that were formerly considered to contain Gila Chub or Headwater Chub are indicated with a footnote.

## **PERFORMANCE MEASURES**

Cooperative Agreement R16AC00077 between U.S. Bureau of Reclamation and Arizona Game and Fish Department specified the following annual performance measures.

1. Complete a minimum of three repatriation stockings and one non-indigenous species control action.

Results: During 2016 Department staff completed 17 repatriation stockings: nine Gila Topminnow, three Desert Pupfish *Cyprinodon macularius*, one Loach Minnow, two Roundtail Chub<sup>1</sup> *Gila robusta*, one Spikedace, and one Longfin Dace *Agosia chrysogaster* (Appendix 1). Also during the performance period Department staff completed four nonnative fish removal efforts in Red Tank Draw, one in the Blue River, one in Redfield Canyon, and assisted with one in Spring Creek.

2. Monitor fish to determine if population(s) have established at all locations where repatriations were attempted within the previous 3 to 5 years, or other period as agreed upon by the CAP Technical and Policy committees. The number of years to monitor is based on life-span and age-at-maturity of the species, and is three years for Gila

---

<sup>1</sup> One of the repatriations was of chub previously classified as Gila Chub.

Topminnow and Desert Pupfish, and five years for Spikedace, Loach Minnow, and Roundtail Chub.

Results: During 2016, Department staff conducted post-stocking monitoring of 43 populations (Appendix 2): 5 Loach Minnow, 5 Spikedace, 10 Desert Pupfish, and 20 Gila Topminnow, 1 Roundtail Chub, 1 Razorback Sucker *Xyrauchen texanus*, and 1 Longfin Dace. Sites where native fish were repatriated and subsequent monitoring information indicated that the species had established populations are reported in Appendix 3.

3. Monitor to determine if non-indigenous fish have been eradicated at all locations where non-indigenous control was attempted within the previous year or other period as agreed upon by the Technical and Policy committees.

Results: During 2016, Department staff monitored three locations where nonnative fish removals have been implemented: Blue River, Redfield Canyon, and Spring Creek.

4. Attempt to spawn all Loach Minnow and Spikedace populations held at the Department's Aquatic Research and Conservation Center (ARCC).

Results: During 2016, all Loach Minnow and Spikedace held at ARCC were dispersed into tanks (containing spawning substrate), to decrease densities and thus facilitate spawning.

## **GENERAL ACTIVITIES**

Activities Performed During 2016: Department staff administered and managed Program projects identified in the agreement. Staff entered data into survey and stocking datasets, and checked data for accuracy. Department staff finalized several annual project reports, drafted the overall annual performance report, drafted Environmental Assessment Checklists, and drafted necessary paperwork to develop a five-year agreement. Department staff hired the vacated Program Biologist position. Staff coordinated with intra-agency staff, other agencies, and private landowners to continue work on existing projects and to develop potential new projects.

Work Planned for 2017: Department staff will administer and manage all aspects of the Program for which they are responsible for. Work will include development of budget and scope of work necessary for the agreement modification; budgeting time and funds to implement priority actions; all coordination and meetings with Department regions, other agencies, and private landowners necessary to plan and implement priority actions; completing Environmental Assessment Checklists necessary to implement priority actions; entering and analyzing data and drafting an annual report.

## **PRIORITY ACTIONS**

### **Acquire Spikedace, Loach Minnow and rare populations of other native fish**

#### Recovery Objectives:

- Spikedace recovery objective 8.2. Collect and transfer wild stocks to suitable facility.
- Loach Minnow recovery objective 8.2. Collect and transfer wild stocks to suitable facility.

Background: The purpose of this task is to acquire Spikedace and Loach Minnow from all extant lineages and bring them to the Department's Aquatic Research and Conservation Center, or another facility, for propagation and to establish refuge populations. The goal is to have 500 adults on station for each lineage. There are few natural populations left, and they need to be protected. Removing too many fish from a wild population could negatively impact it. The number of fish to remove from a given population is a coordinated decision between USFWS and state wildlife agencies, and is usually based on monitoring information about the estimated number of fish in the stream.

Loach Minnow (Aravaipa Creek lineage) were first brought into the ARCC in August 2002 to develop propagation techniques (Childs 2004). Spikedace and more Loach Minnow from Aravaipa Creek were brought on station in 2007 to establish broodstocks. Since then the number of fish and lineages brought each year has fluctuated from none to several hundred. Spikedace from Aravaipa Creek, Upper Gila River, and Gila River Forks), and Loach Minnow from Aravaipa Creek, Blue River and upper Gila River were brought on station in 2009. Only twice have more than 300 individuals of a given lineage been brought into the facility: 640 upper Gila River Spikedace in 2007, and 434 Gila River Forks Loach Minnow in 2011.

Results: In May 2016 Department staff coordinated with New Mexico Department of Game and Fish (NMDGF) regarding bringing more Spikedace and Loach Minnow from New Mexico into ARCC. The NMDGF reiterated their position that they had expressed at the December 10, 2015 CAP Technical Committee Meeting that they wanted to conduct direct translocations of Spikedace and Loach Minnow in New Mexico, rather than delivering more fish to ARCC. Therefore, no additional New Mexico Spikedace or Loach Minnow were brought into ARCC in 2016.

On July 14, 2016 Department staff removed 43 Loach Minnow from the Blue River near Upper Blue Campground and brought them to the ARCC to add to the broodstock. The number brought in was greater than what was previously agreed upon in coordination with the USFWS, so 31 Loach Minnow were returned to the Blue River on August 8, 2016.

On November 28, 2016 Department staff removed 200 Loach Minnow and 80 Spikedace from upper Aravaipa Creek and transported them to the ARCC to add to the broodstock. The number brought in was what was agreed upon in coordination with the USFWS.

Recommendations: Continue to collect Spikedace and Loach Minnow from remnant populations, with goals to minimize impact on remnant population but acquiring the number of fish necessary to maintain a refuge population of at least 500 adults.

Work Planned for 2017: Coordinate with USFWS to determine number of fish to remove from each remnant population. Translocate Spikedace and Loach Minnow from Aravaipa Creek to ARCC. Translocate Blue River Loach Minnow to ARCC. If an agreement is developed with White Mountain Apache Tribe, acquire White River Loach Minnow and bring to ARCC.

### **Muleshoe ecosystem stream and spring repatriations**

#### Recovery Objectives:

- Spikedace recovery objective 6.3. Reintroduce Spikedace to selected reaches.
- Spikedace recovery objective 6.4. Monitor success/failure of reintroductions.
- Loach Minnow recovery objective 6.3. Reintroduce Loach Minnow to selected reaches.
- Loach Minnow recovery objective 6.4. Monitor success/failure of reintroductions.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Gila Topminnow recovery objective 1.214. Remove *Gambusia affinis* and/or other undesirable nonnative fishes from topminnow habitats when detrimental.
- Desert Pupfish recovery objective 2. Re-establish Desert Pupfish populations.
- Desert Pupfish recovery objective 5. Monitor and maintain natural, re-established, and refugium populations.
- Gila Chub draft recovery plan objective 1.3.1. Eliminate or control problematic nonnative aquatic organisms
- Gila Chub draft recovery plan objective 2. Ensure representation, resiliency, and redundancy by expanding the size and number of populations within Gila chub historical range via replication of remnant populations within each RU.
- Gila Chub draft recovery plan objective 7. Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.

Background: The purpose of this action was to establish Spikedace, Loach Minnow, Gila Topminnow, and Desert Pupfish into various waters on the Muleshoe Ranch Cooperative Management Area. The Muleshoe CMA is located on the western slopes of the Winchester and Galiuro mountains. Fish stockings began in 2007, when Spikedace and Loach Minnow were stocked into Hot Springs Canyon and Redfield Canyon; both species were again stocked into



Redfield Canyon in 2008 and 2010, and into Hot Springs Canyon each year through 2011. In 2007, Roundtail Chub<sup>1</sup> were translocated upstream of a waterfall in Redfield Canyon to expand their range in that system. Gila Topminnow and Desert Pupfish were stocked into Swamp Springs Canyon (2007 and 2008), Cherry Spring Canyon (2007 and 2008), and Secret Spring (2007 and desert pupfish only in 2010). Gila Topminnow and Desert Pupfish were stocked into Headquarters Spring in 2008, and in 2010 more pupfish were added. Gila Topminnow was stocked into Wildcat Canyon in 2014 and into Bass Canyon in 2014 and 2015. Desert Pupfish were stocked into Larry & Charlie Tank in 2009 and into Mint Spring in 2015.

Both Redfield Canyon and Hot Springs Canyon drainages are occupied by other native fishes including: Roundtail Chub<sup>2</sup>, Speckled Dace *Rhinichthys osculus*, Longfin Dace, Desert Sucker *Catostomus clarki*, and Sonora Sucker *Catostomus insignis*.

Results: Department staff coordinated with members of the Muleshoe Native Fish Team (Department, USFWS, U. S. Bureau of Land Management, U. S. Bureau of Reclamation, and The Nature Conservancy) about the monitoring of native fishes in Muleshoe CMA waters planned for September 2016. Department staff also planned all of the logistics for the sampling. During September 19 -21, 2016, Department, BLM, USFWS, and TNC staff monitored Hot Springs Canyon and Redfield Canyon for Loach Minnow and Spikedace, Mint Spring for Desert Pupfish, and Upper Bass Canyon, Lower Bass Canyon, and Wildcat Canyon for Gila Topminnow. Department and TNC staff also conducted the annual Green Sunfish *Lepomis cyanellus* removal in lower Redfield Canyon. In the nine electrofishing transects sampled within Hot Springs Canyon, 70 Loach Minnow, 1 Spikedace, 421 Speckled Dace 197 Longfin Dace, 62 Roundtail Chub, 151 Desert Sucker and 13 Sonora Sucker were captured (Table 1). Loach Minnow catch rates were greater than previous years, but overall the catch has fluctuated and they have been consistently captured each year since the last stocking in 2011 (Figure 1). One of the 70 Loach Minnow captured in 2016 was released before it was measured. Of the 69 that were measured, three were < 40 mm TL and 14 were < 45 mm; these fish were likely young-of-year (Figure 2). Therefore it does appear that Loach Minnow have established a small population. The one Spikedace captured was 69 mm TL. Number of Spikedace captured has decreased every year since they were last stocked in 2011 (Figure 3), and only two YOY have ever been detected, one in 2013 and one in 2015 (Figure 4). Therefore it appears that Spikedace failed to establish. No Spikedace or Loach Minnow were captured in Redfield Canyon (Table 1). Catch rates overall were fairly low compared to past years (Love-Chezem et al 2015a), and only two fish were captured in Reach 2: a Gila Topminnow and a Green Sunfish. In Reach 1, captured fish included Roundtail Chub, Speckled Dace, Sonora Sucker, and one Green Sunfish. The two Green Sunfish captured in the upper two reaches were 129 and 151 mm TL. Hoop nets and collapsible minnow traps were used for the Green Sunfish removal in Redfield Canyon, which was focused on a location near the western wilderness boundary. In 16 mini-hoop nets

---

<sup>1</sup> Chub in Hot Springs and Redfield canyons were previously classified as Gila Chub.

and two collapsible minnow traps, a total of 127 Green Sunfish, 5 Gila Topminnow, and 2 Sonora Sucker were captured (Table 2); the sunfish were removed from the stream. Green Sunfish numbers remain low in Reach 1, and catch in Reach 3 seems to be decreasing since 2014 (Figure 5).

For the Gila Topminnow and Desert Pupfish monitoring, no pupfish were captured at Mint Spring, 448 topminnow were captured in Wildcat Canyon, and 70 topminnow were captured at the upper Bass Canyon site, but none in the lower Bass Canyon site (Table 3). There was evidence of reproduction by Gila Topminnow at Wildcat Canyon (61 were  $\leq 20$  mm TL), and at upper Bass Canyon (54 were  $\leq 20$  mm TL).

On October 12, 2016 Department staff stocked 292 Desert Pupfish into Mint Spring and 533 Gila Topminnow into lower Bass Canyon. Desert Pupfish were collected earlier in the day from the Phoenix Zoo. Gila Topminnow were collected from Gatewood Spring (also known as Secret Spring) at Muleshoe Ranch CMA. Fish behaved normally upon release. There were 8 Gila Topminnow mortalities during transport.

Recommendations: As of the end of 2016, the multi-agency Muleshoe Native Fish Conservation Team had completed five years of post-stocking monitoring in Hot Springs Canyon and Redfield Canyon. Loach Minnow are considered established in Hot Springs Canyon, but Spikedace numbers have decreased and likely have failed to establish. The multi-agency team recommended that annual monitoring be continued in Hot Springs Canyon. Neither Spikedace nor Loach Minnow established in Redfield Canyon so continued annual monitoring is not necessary. Instead it is recommended that the fish assemblage in Redfield Canyon be monitored every three years. The team also recommended that the translocated chub population above the waterfall, which has not yet been surveyed with capture gear, be monitored during the triennial monitoring.

Monitoring of Gila Topminnow in Wildcat Canyon should continue for one more year to determine if they have established. Monitoring of Gila Topminnow in Bass Canyon should continue until 2019 because more were stocked in 2016. Gila Topminnow should be stocked into lower Double R Canyon in 2017, and then monitored for at least three years afterward to determine if they establish.

Monitoring of Desert Pupfish in Mint Spring should continue until at least 2019. More Desert Pupfish should be stocked into Mint Spring if low numbers are captured during 2017 monitoring. More Desert Pupfish should be stocked into Larry & Charlie Spring and Secret Spring as numbers appear to be low in those locations.

Work Planned for 2017: Department staff plan to do the following work in 2017: 1) assist the TNC with wet-dry mapping in Hot Springs Canyon to better determine the extent of habitat

suitable for Spikedace and Loach Minnow; 2) Green Sunfish removal from Redfield Canyon in spring; 3) annual monitoring of the fish assemblage in Hot Springs Canyon, Wildcat Canyon, Bass Canyon, Mint Spring; 4) monitoring of chub in Redfield Canyon upstream of the waterfall; 5) stocking of Gila Topminnow into Double R Canyon, and into Bass Canyon if necessary; 6) stocking of Desert Pupfish into Mint Spring, Larry & Charlie Spring, and Secret Spring if fewer than 50 are captured during monitoring.

### **Fossil Creek repatriations**

#### Recovery Objectives:

- Spikedace recovery objective 6.3. Reintroduce Spikedace to selected reaches.
- Spikedace recovery objective 6.4. Monitor success/failure of reintroductions.
- Loach Minnow recovery objective 6.3. Reintroduce Loach Minnow to selected reaches.
- Loach Minnow recovery objective 6.4. Monitor success/failure of reintroductions.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Razorback Sucker recovery objective 5.3.1.1.2.2. Two self-sustaining populations (e.g., mainstem and/or tributaries) are maintained over a 5-year period, starting with the first point estimate acceptable to the Service.

Background: The purpose of this action was to establish Spikedace, Loach Minnow and Gila Topminnow, grow Razorback Sucker, and augment Longfin Dace in Fossil Creek. Spikedace were stocked in 2007, 2008, 2010-12, Loach Minnow in 2007, 2008, 2010, 2011, and 2013, Gila Topminnow in 2007-2011, Razorback Sucker in 2008, 2009, and 2014, and Longfin dace in 2008 and 2009. Post-stocking monitoring began in 2008 and was completed every year thereafter.

Results: On August 1, 2016, Department and Bureau of Reclamation staff surveyed Fossil Creek from Fossil Springs Dam to Fossil Springs (Reach 0) for Loach Minnow. Staff snorkeled through 25 meters every 100 m regardless of habitat type (6 sites), and snorkeled through all riffles in the reach. In Reach 0, no Loach Minnow were observed; species detected in this reach included Roundtail Chub<sup>2</sup>, Speckled Dace, and Desert Sucker. Loach Minnow were last detected in Fossil Creek in 2014.

On August 15-16, 2016, Department staff surveyed Fossil Creek from High Falls to Fossil Springs Dam (Reach 1) and from the constructed fish barrier to Sally May Wash (Reach 4) for Spikedace. At 100-m intervals, 25 m of stream was snorkeled through, regardless of habitat type. In Reach 1 (41 sites), no Spikedace or Loach Minnow were observed; species detected in

---

<sup>2</sup> Chub in reaches 0, 1, and 2 of Fossil Creek were previously classified as Headwater Chub.

this reach included 2 Gila Topminnow (not classified to size), Roundtail Chub<sup>2</sup>, Desert Sucker, Sonora Sucker, and Speckled Dace. Mean observation rate for Gila Topminnow was 0.29±0.20 fish/hr. In Reach 4 (47 sites), 47 Spikedace (44 were >40 mm, 2 were ≤40 mm, and 1 was not classified to size), 16 Gila Topminnow (>20mm), and 6 Longfin Dace (>40 mm) were observed; other species detected in this reach included Roundtail Chub, Desert Sucker, Sonora Sucker, and Speckled Dace. Mean Observation rates for Spikedace, Gila Topminnow, and Longfin Dace were 5.05±1.77 fish/h, 0.13±0.07 fish/h, and 0.34±0.26 fish/h, respectively. Overall, Spikedace, Gila Topminnow, and Longfin Dace abundance decreased in Fossil Creek in 2016 compared to 2015. However, this could be due to low visibility during snorkel surveys caused by high turbidity. Spikedace continue to persist in Reach 4 and appear to be established; however, this is the second year that Spikedace were not detected in Reach 1.

Due to cloud cover and lightening, Department staff did not conduct surveys for Razorback Suckers from Sally May Wash to Irving Falls (Reach 3) in 2016, but none were detected in the above mentioned Spikedace snorkel surveys in Reach 4.

Recommendations: Spikedace and Gila Topminnow are considered established, and Loach Minnow and Razorback Sucker failed to establish. This project should be considered completed and removed from the list of priority actions. Continued monitoring of the Spikedace and Gila Topminnow populations should be done by another program (Department's Region II or Native Aquatics Program) or agency on a triennial basis.

Work Planned for 2017: None, project should be considered completed.

## **Fresno Canyon repatriations**

### Recovery Objectives:

- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Gila Chub draft recovery plan objective 2. Ensure representation, resiliency, and redundancy by expanding the size and number of populations within Gila chub historical range via replication of remnant populations within each RU.
- Gila Chub draft recovery plan objective 7. Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.

Background: The purpose of this action was to establish Gila Topminnow and Roundtail Chub<sup>1</sup> into Fresno Canyon. Fresno Canyon was treated with rotenone in 2007 to remove Green Sunfish. Afterwards, Gila Topminnow naturally colonized from upstream Coal Mine Canyon,

---

<sup>2</sup> Chub in reaches 0, 1, and 2 of Fossil Creek were previously classified as Headwater Chub.

<sup>1</sup> Chub to be repatriated were previously classified as Gila Chub.

but topminnow and longfin Dace were also stocked in 2008. The plan was to also stock Roundtail Chub (Sheehy Spring lineage), but that was delayed until after a Habitat Conservation Plan could be completed for the private land on which Sheehy Spring is located.

Results: The Department's Aquatic Wildlife Branch staff coordinated potential native fish conservation actions with the landowner while they surveyed Sheehy Spring on June 20, 2016.

Recommendations: The landowner and USFWS finished the Habitat Conservation Plan late in 2016. Therefore, Department staff can now coordinate native fish conservation actions specified in the plan with the landowner.

Work Planned for 2017: Work planned for 2017 includes coordination with landowner of Sheehy Spring to acquire chub for ARCC. A fish health assessment will be done at least one month prior to bringing any chub into ARCC. Because chub abundance is too low to sacrifice 30-60 individuals, Western Mosquitofish will be assessed as a surrogate for chub. Adult chub brought into ARCC will be injected with hormones to facilitate spawning. Fish produced can be stocked out into Fresno Canyon in 2017 or 2018.

### **Bonita Creek renovation and repatriations**

#### Recovery Objectives:

- Spikedace recovery objective 6.2.5 Reclaim as necessary to remove non-native fishes.
- Spikedace recovery objective 6.3. Reintroduce Spikedace to selected reaches.
- Spikedace recovery objective 6.4. Monitor success/failure of reintroductions.
- Loach Minnow recovery objective 6.2.5 Reclaim as necessary to remove non-native fishes.
- Loach Minnow recovery objective 6.3. Reintroduce Loach Minnow to selected reaches.
- Loach Minnow recovery objective 6.4. Monitor success/failure of reintroductions.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Gila Topminnow recovery objective 1.214. Remove *Gambusia affinis* and/or other undesirable nonnative fishes from topminnow habitats when detrimental.
- Desert Pupfish recovery objective 2. Re-establish Desert Pupfish populations.
- Desert Pupfish recovery objective 5. Monitor and maintain natural, re-established, and refugium populations.

Background: The Department, Bureau of Land Management, Reclamation, and USFWS began implementing a native fish restoration project in Bonita Creek near Safford during 2008 with the construction of a fish barrier. The same year, a reach between the City of Safford infiltration gallery dike and the constructed fish exclusion barrier was chemically treated with rotenone to

eliminate nonnative fishes (Robinson et al., 2009). Following the renovation, salvaged native fishes including Roundtail Chub<sup>1</sup>, Longfin Dace, Speckled Dace, Sonora Sucker, and Desert Sucker were returned to the renovated reach. In addition, federally-listed Loach Minnow, Spikedace, Desert Pupfish, and Gila topminnow were translocated to and stocked into the stream. Nonnative fish were found in the treated reach in 2009, and Bureau of Land Management began leading efforts to mechanically remove them. The Department did not, nor plan to stock anymore threatened and endangered fish into the treated reach until the nonnative fishes could be eradicated.

However, the Department stocked the same threatened and endangered fish into upper Bonita Creek, which is free of nonnative fishes except fathead minnow. Spikedace were stocked near a location known as Red Knoll in 2009 and in 2010 both Spikedace and Loach Minnow were stocked there (Figure 6). Desert Pupfish and Gila Topminnow were stocked at Lee Trail in 2010 and at Red Knoll in 2011. Of the species stocked, only Gila Topminnow were captured during annual monitoring by BLM, and appeared to have established at Red Knoll. The agencies discussed additional stockings, and in 2014 Desert Pupfish and Gila Topminnow were stocked near the Reservation Boundary, and Gila Topminnow and Loach Minnow near Midnight Canyon. More Gila Topminnow and Desert Pupfish were stocked near the Reservation Boundary in 2015. The Department monitored for these three species afterwards because the stocking locations were outside of the BLM fixed monitoring sites.

Results: On September 29, 2016 Department staff monitored for Gila Topminnow, Desert Pupfish, and Loach Minnow in upper Bonita Creek (Table 4). Collapsible minnow traps were set at the reservation boundary Gila Topminnow and Desert Pupfish stocking pools and at the Gila Topminnow stocking site near the confluence of Midnight Canyon. Thirty-one Gila Topminnow were captured at the Reservation Boundary stocking site (beaver pond; Table 4), nine of which were < 20 mm TL. No Desert Pupfish were captured at the Reservation Boundary stocking site (beaver pond). A Black-necked Gartersnake was also captured, by hand, near the Desert Pupfish stocking site at the Reservation boundary. Fifty-five Gila Topminnow were captured at the Midnight Canyon stocking location (Table 4), all of which were > 20 mm TL.

Loach Minnow were monitored using single-pass electrofishing (riffles were kick-seine electrofished) at one fixed and two randomly selected 100-m transects downstream of the Midnight Canyon confluence. No Loach Minnow were captured. Species captured in order of abundance were Speckled Dace, Sonora Sucker, Desert Sucker, Sonora Sucker, Roundtail Chub<sup>1</sup>, Gila Topminnow, Longfin Dace, and Fathead Minnow (Table 4). Gila Topminnow persist and are likely establishing at the Reservation Boundary and Midnight Canyon stocking

---

<sup>1</sup> Chub in Bonita Creek were previously classified as Gila Chub.

<sup>1</sup> Chub in Bonita Creek were previously classified as Gila Chub.

locations; however, the beaver pond at Midnight Canyon where they were stocked is gone. It is unclear if Desert Pupfish or Loach Minnow persist in upper Bonita Creek.

Recommendations: The Department, BLM, and USFWS should survey habitat in the reach between Red Knolls and Midnight Canyon to see if consensus can be reached about suitability of habitat for loach minnow. If deemed suitable, then more Loach Minnow should be stocked in 2017. Regardless, annual monitoring for Loach Minnow between Midnight Canyon and Cottonwood Canyon should be completed through 2019.

Monitoring of Desert Pupfish and Gila Topminnow at the Reservation Boundary sites and Gila Topminnow at the Midnight Canyon site, should continue until at least 2018. If few Gila Topminnow are detected, more should be stocked to help them establish. Desert Pupfish do not appear to be establishing, so further augmentations are not recommended at this time.

Work Planned for 2017: Department staff will monitor Gila Topminnow at the Reservation Boundary and Midnight Canyon stocking sites, Desert Pupfish at the Midnight Canyon stocking site, and Loach Minnow in the reach between Midnight Canyon and Sycamore Canyon. Department staff will coordinate with BLM and USFWS to schedule a trip to assess habitat for Spikedace and Loach Minnow between Red Knolls and Midnight Canyon. Based on monitoring results and recommendations from partners, more Loach Minnow and Gila Topminnow may be stocked.

### **Arizona trout stream Loach Minnow repatriations**

#### Recovery Objectives:

- Loach Minnow recovery objective 6.3. Reintroduce Loach Minnow to selected reaches.
- Loach Minnow recovery objective 6.4. Monitor success/failure of reintroductions.

Background: The purpose of this project was to stock Loach Minnow into secure Apache Trout Recovery streams. During 2007-2009 Department staff coordinated with Apache-Sitgreaves National Forest and the Department's Region 1 regarding potential repatriation streams. The best potential streams were determined to be West Fork Black River and Bear Wallow Creek. Fish Creek was a third choice, but became impaired after the 2011 Wallow Fire, which caused damage to the existing fish barrier. Much work is required before Loach Minnow could be repatriated. The Department's Sport Fish Conservation and Mitigation Program (CAMP) began in 2011, and had a similar project, therefore the Department decided to have the CAMP program implement the Loach Minnow repatriations in Apache Trout streams. The preferred source lineage was East Fork Black River, but unfortunately it was last captured in 2006. The next preferred source is White River, but that is on White Mountain Apache Tribe (WMAT) land. The Department and U. S. Forest Service (USFS) have been communicating with WMAT for

years to acquire White River Loach Minnow and bring them to the hatchery. The Program provided funds to WMAT to conduct surveys to better determine the status of Loach Minnow in the White River drainage.

Results: The Department's CAMP program is leading this action. Department staff met with Apache-Sitgreaves National Forest staff on January 19 to discuss the Bear Wallow Creek project (repair the lower barrier, treat the stream with rotenone, and stock Apache Trout and Loach Minnow). Later on January 19, Department staff attended the annual Spikedace and Loach Minnow Conservation Team Meeting and discussed potential repatriations of Loach Minnow to two Apache Trout repatriation streams: Bear Wallow Creek and West Fork Bear Wallow Creek. On March 30, 2016 Department staff met with Apache-Sitgreaves National Forest to coordinate aquatic wildlife projects, and discussed the repatriations of Loach Minnow to West Fork Black River and Bear Wallow Creek planned for 2018 or later.

Recommendations: The project could be dropped from the list of priority actions, because the Department's CAMP program is implementing the actions.

Work Planned for 2017: No work is planned because the project should be dropped from the list of priority actions.

### **Gila Topminnow stockings**

#### Recovery goals(s):

- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Desert Pupfish recovery objective 2. Re-establish Desert Pupfish populations.
- Desert Pupfish recovery objective 5. Monitor and maintain natural, re-established, and refugium populations.

Overall Background: The purpose of this action is to establish Gila Topminnow populations throughout the Gila River Basin in Arizona. The target is six new repatriations per year. Desert Pupfish are sometimes stocked into the same sites because the species utilize similar habitats. The Department coordinates with USFWS about locations to stock and sources and lineages of fish to use. The strategy is to stock over 500 Gila Topminnow initially, and for any subsequently needed augmentations to establish a population. If during monitoring, catch indicates that the species is reproducing and the population growing, then no additional fish are stocked. After stocking the populations are monitored at 6-months and then annually thereafter for three years after the last stocking event. If they are considered established after the third post-stocking monitoring, then the monitoring responsibilities are passed on to other Department programs or other agencies. Monitoring techniques are consistent from year to year for a given site, and



usually involve 10 minnow trap sets per site, but dip nets or seines are sometimes used if habitat is amenable.

Overall Work Planned for 2017: Department staff plan to stock Gila Topminnow into 10 new sites in 2017: Indian Creek and Sycamore Creek in the Agua Fria River drainage on Prescott National Forest; Copper Creek in the Agua Fria River drainage, Haunted Canyon, West Fork Pinto Creek, Charlebois Spring (previously occupied by Gila Topminnow), upper Tortilla Creek, and Rock Creek in the Salt River drainage; and Maternity Wildlife Pond and Oil Tank Wildlife Pond on Las Cienegas Wildlife Area. Each of these will be monitored 6-months after being stocked. Some of these are pending federal agency environmental compliance or Endangered Species Act section 7 consultations. The remainder of the work planned for 2017 is presented below under specific sites. Note that a few other Gila Topminnow stockings into new locations are planned under other priority actions.

Sites Visited During 2016:

*Las Cienegas National Conservation Area-Bill's Wildlife Pond*

Background: Bill's Wildlife Pond is located in the Gardner Canyon drainage about 2.1 km upstream of the confluence with Cienega Creek. In spring of 2016 BLM informed the Department that work on the pond was completed and it was ready for fish.

Results: On August 29, 2016, Department and Bureau of Land Management (BLM) staff stocked 841 Gila Topminnow into Bill's Wildlife Pond. Fish behaved normally upon release; there were no mortalities during translocation. Gila Topminnow were collected earlier in the day from Crescent and Egret Ponds (Cienega Creek lineage).

Recommendations: This was the first stocking of Bill's Wildlife Pond, so the site will be monitored until at least 2019. Additional stockings may be needed to help Gila Topminnow establish.

Work Planned for 2017: Department staff will perform annual monitoring, and will stock more Gila Topminnow if low numbers are captured.

*Las Cienegas National Conservation Area-Cinco Canyon Pond*

Background: Cinco Canyon Pond is located in the Cinco Canyon drainage about 3.9 km upstream of the confluence with Cienega Creek. On July 15, 2013 Department and BLM staff stocked 250 Desert Pupfish into Cinco Canyon Pond. The fish originated from Robbins Butte Wildlife Area Twin Tanks, Desert Botanical Garden, Deer Valley High School, and Spur Cross Conservation Area.

Results: Department staff monitored fish in Cinco Canyon Pond on August 23, 2016. Staff set 10 minnow traps and captured 761 Desert Pupfish (612 were >20 mm, 149 were ≤20 mm) and 1 adult Lowland Leopard Frog.

Recommendations: This was the third year of post-stocking monitoring, so based on catch over that period, Desert Pupfish are considered established at Cinco Canyon Tank. Additional augmentation may be periodically necessary to ensure genetic diversity. Since Desert Pupfish is considered established in Cinco Canyon Pond, future stockings and monitoring can be performed by other AGFD programs (Native Aquatic Program or Region V Fisheries Program), or monitoring could be performed by another agency. Status of the population should be reported to AGFD, Reclamation, and USFWS.

Work Planned for 2017: None, because Desert Pupfish are considered established.

#### *Las Cienegas National Conservation Area-Clyne Pond*

Background: Clyne Pond is located in the Mud Springs Canyon drainage about 10.5 km upstream of the confluence with Cienega Creek. The pond is adjacent to a private ranch, and the rancher uses the pond to provide water to his livestock. On August 19, 2015 Department and BLM staff stocked 501 Gila Topminnow into Clyne Pond.

Results: Department staff monitored Clyne Pond on August 22, 2016. Staff set 10 minnow traps but no Gila Topminnow were captured. Leopard frogs were present at the site. Department and BLM staff discussed and recommended more topminnow be stocked.

On August 30, 2016, Department and BLM staff stocked 541 Gila Topminnow and 76 Roundtail<sup>1</sup> Chub into Clyne Pond. Fish behaved normally upon release; however, there were three Gila Topminnow and three Roundtail Chub mortalities during translocation. Gila Topminnow were collected earlier in the day from Road Canyon Tank (Cienega Creek lineage), and Roundtail Chub were collected earlier in the day from Cienega Creek near Gardner Canyon confluence.

Recommendations: Gila Topminnow were stocked in 2015 and 2016, so a determination on species establishment will not be made until at least 2019. However, because Roundtail Chub were also stocked, the site will be monitored until at least 2021. Additional Gila Topminnow may be stocked to help the species establish. At least 425 more Roundtail Chub should be stocked to attain a founding population size of 500.

Work Planned for 2017: Department staff will monitor the chub and Gila Topminnow in Clyne Pond. More chub will be stocked, but the number stocked may be lower than 425 if chub

---

<sup>1</sup>Chub in Cienega Creek and stocked into Clyne Pond were previously classified as Gila Chub.

abundance in Cienega Creek is low. More Gila Topminnow will be stocked if fewer than 100 are captured during monitoring.

#### *Las Cienegas National Conservation Area-Cottonwood Wildlife Pond*

Background: Cottonwood Wildlife Pond is located in the Gardner Canyon drainage about 5.2 km upstream from the confluence with Cienega Creek. The pond is one of a set of two, and is separated from the second pond by a berm and fence. Livestock are allowed to water in the north pond but are excluded from the south pond. Department and BLM staff stocked 269 Desert Pupfish into the south pond on July 15, 2013, and 177 on October 1, 2014. Only four Desert pupfish were captured during monitoring in August 2014, which was why more were stocked in October. During the July 2015 monitoring, 851 Desert Pupfish were captured.

Results: On August 22, 2016, Department staff surveyed Cottonwood Wildlife Pond. They set 11 minnow traps and 4 dip net sweeps and captured 34 Desert Pupfish (30 were >20 mm, 4 of which were ≤20 mm). Leopard frogs were also present at the site.

Recommendations: Desert Pupfish were stocked in 2013 and 2014, so monitoring needs to continue until at least 2017. Additional stockings may be necessary to help the species establish.

Work Planned for 2017: Department staff will monitor the Desert Pupfish in Cottonwood Wildlife Pond and stock more if fewer than 100 are captured.

#### *Las Cienegas National Conservation Area-Crescent Wildlife Pond*

Background: Crescent Wildlife Pond is one of three ponds in the Cieneguita Wetland in the Empire Gulch drainage about 2.1 km upstream of the confluence with Cienega Creek. It was previously referred to as Cieneguita Wetland Pond #3. In July 2013, Department and BLM staff stocked 290 Desert Pupfish and 240 Gila Topminnow into Crescent Wildlife Pond. The Desert Pupfish were acquired from Robbins Butte Wildlife Area's Twin Tanks, Desert Botanical Garden, Deer Valley High School, McDowell Mountain Regional Park's Nursery Tank, International Wildlife Museum, and Spur Cross Conservation Area. The Gila Topminnow were captured from Cienega Creek.

Gila Topminnow and Desert Pupfish were captured during the first two years of monitoring. During monitoring in August 2014, 1108 Gila Topminnow and 354 Desert Pupfish were captured. During the August 2015 monitoring, 1,016 Gila Topminnow and 2 Desert Pupfish were captured. Because so few Desert Pupfish were captured in 2015, the Department staff recommended that more be stocked to help establish the population.

Results: At Crescent Pond, 6 minnow traps and 2 dip net sweeps captured 764 Gila Topminnow (555 were >20 mm, 209 were ≤20 mm) and 19 Desert Pupfish (18 were >20 mm, 1 were ≤20 mm).

On August 29, 2016, Department and BLM staff stocked 216 Desert Pupfish into Crescent Pond. There were 5 mortalities during translocation. Desert Pupfish were collected earlier in the day from Cottonwood Tank at Robbins Butte Wildlife Area (Santa Clara Slough lineage).

Recommendations: This was the third year of post-stocking monitoring, so based on catch over that period, Gila Topminnow are considered established at Crescent Wildlife Pond. However, because desert pupfish were stocked in 2016, monitoring should continue until 2019.

Work Planned for 2017: Department staff will monitor Desert Pupfish in Crescent Wildlife Pond.

#### *Las Cienegas National Conservation Area-Egret Wildlife Pond*

Background: Egret Wildlife Pond is one of three ponds in the Cieneguita Wetland in the Empire Gulch drainage about 2.1 km upstream of the confluence with Cienega Creek. It was previously referred to as Cieneguita Wetland Pond #1. In May 2013, Department and BLM staff stocked 751 Gila Topminnow and on August 19, 2015 they stocked 99 Desert Pupfish into Egret Wildlife Pond.

During the August 2014 monitoring, 2,452 Gila Topminnows were captured. During the July 14, 2015 monitoring, 768 Gila Topminnow and 115 Desert Pupfish were captured. Pupfish were not stocked into the pond, and BLM staff thought that fish may have moved during monsoonal rains when the wetland was inundated with water. Because the Desert Pupfish population started with an unknown number of individuals, the Department decided to augment the population.

Results: Department staff monitored fish in Egret Pond on August 22, 2017. They set 10 minnow traps and made 1 dip net sweep and captured 1,784 Gila Topminnow (1,174 were >20 mm, 610 were ≤20 mm) and 45 Desert Pupfish (29 were >20 mm, 16 were ≤20 mm).

On August 29, 2016, Department and BLM staff stocked 252 Desert Pupfish into Egret Pond. There were six mortalities during translocation. Desert Pupfish were collected earlier in the day from Cottonwood Tank at Robbins Butte Wildlife Area (Santa Clara Slough lineage).

Recommendations: This was the third year of post-stocking monitoring, so based on catch over that period, Gila Topminnow are considered established at Egret Wildlife Pond. However, because desert pupfish were stocked in 2016, monitoring should continue until 2019.

Work Planned for 2017: Department staff will monitor fish in Egret Wildlife Pond.

*Las Cienegas National Conservation Area-Empire Pond*

Background: Empire Pond is located adjacent to Empire Well in the Empire Gulch drainage, about 11 km upstream of the confluence with Cienega Creek. In July 2013 Department and BLM staff stocked 299 Desert Pupfish and 313 Gila Topminnow into Empire Pond. The pupfish were acquired from McDowell Mountain Park's Nursery Tank, TNC Lower San Pedro River Preserve, and International Wildlife Museum. The topminnow were collected from Cienega Creek.

During the August 2014 monitoring, 959 Gila Topminnow and 40 Desert Pupfish were captured. During the July 2015 monitoring, 1,533 Gila Topminnow and 153 Desert Pupfish were captured. Both juvenile and adult fish of each species were captured each year.

Results: Department staff monitored Empire Pond on August 22, 2016. Staff set nine minnow traps and captured 1,722 Gila Topminnow (1,199 were >20 mm, 523 were ≤20 mm) and 223 Desert Pupfish (186 were >20 mm, 37 were ≤20 mm). Thousands of Gila Topminnow were also observed and leopard frogs were present at the site.

Recommendations: This was the third year of post-stocking monitoring, so based on catch over the last three years Gila Topminnow and Desert Pupfish are considered established at Empire Tank. Additional augmentations of Gila Topminnow and Desert Pupfish may be necessary in the future to maintain genetic diversity. Since the two species are considered established in Empire Pond, future stockings and monitoring can be performed by other AGFD programs (Native Aquatic Program or Region V Fisheries Program), or monitoring could be performed by another agency. Status of the populations should be reported to AGFD, Reclamation, and USFWS.

Work Planned for 2017: None because Gila Topminnow and Desert Pupfish are considered established.

*Las Cienegas National Conservation Area-Gaucha Wildlife Pond*

Background: Guacho Wildlife Pond is located in the Gardner Canyon drainage about 1.3 km east of Cottonwood Wildlife Pond. Gila Topminnow was discovered in Guacho Wildlife Pond in 2014, and likely were inadvertently transferred to the pond in aquatic plants when preparing the pond for frogs. Because the founder population was unknown, Department staff stocked 512 Gila Topminnow in 2014 to increase genetic diversity. Guacho Tank was monitored in July 2015 using 10 minnow traps and 1,145 Gila topminnow (858 were > 20 mm, 287 were ≤ 20 mm), 25 desert pupfish (16 were > 20 mm, 8 were ≤ 20 mm, 1 unclassified mortality), and 1 leopard frog tadpole were captured. Desert pupfish were also not stocked into Guacho Tank. It is possible

that desert pupfish were also unintentionally introduced when aquatic vegetation was translocated into the pond to benefit Chiricahua leopard frog reintroduction. Because the founding population was unknown, Department staff stocked 365 Desert Pupfish into Gaucho Wildlife Pond in August 2015.

Results: On August 23, 2016, Department staff monitored Gaucho Wildlife Pond. Staff set 10 minnow traps and captured 1,132 Gila Topminnow (948 were >20 mm, 183 were ≤20 mm, and 1 mortality) and 56 Desert Pupfish (54 were >20 mm, 2 were ≤20 mm). Thousands of fish were also observed swimming near the surface; leopard frogs were present at the site.

Recommendations: Gila Topminnow were stocked in 2014, and Desert Pupfish in 2015, so this site will be monitored until at least 2018. Additional stockings of the two species may be necessary to establish populations.

Work Planned for 2017: Department staff will monitor fish in Gaucho Wildlife Pond and stock more Gila Topminnow and Desert Pupfish if deemed necessary.

#### *Las Cienegas National Conservation Area-Heart Wildlife Pond*

Background: Heart Wildlife Pond is one of three ponds in the Cieneguita Wetland in the Empire Gulch drainage about 2.1 km upstream of the confluence with Cienega Creek. It was previously referred to as Cieneguita Wetland Pond #4. Department and BLM staff stocked 199 Desert Pupfish on May 6, 2013. The pupfish originated from Robbin's Butte Cottonwood Tank and International Wildlife Museum. During monitoring in August 2014, 328 Desert Pupfish were captured; 39% were <20 mm TL (Love-Chezem et al. 2015). During the next monitoring on July 14, 2015, only 31 Desert Pupfish were captured. Therefore, Department staff recommended that more be stocked to help the population establish. On August 19, 2015, an additional 99 Desert Pupfish were stocked; these were acquired from Robbins Butte and TNC Lower San Pedro River Preserve pond (Mosher et al 2016).

Results: Department staff monitored fish in Heart Wildlife Pond on August 22, 2017. They set six minnow traps and captured 73 Desert Pupfish (49 were >20 mm, 24 were ≤20 mm) and 3 leopard frogs (1 tadpole).

Recommendations: Desert Pupfish were stocked in 2013 and 2015, so this site will be monitored until 2018. One more stocking may be done to help the species establish.

Work Planned for 2017: Department staff will monitor Desert Pupfish in Heart Wildlife Pond and may stock more if deemed necessary.

#### *Las Cienegas National Conservation Area-Little Nogales Spring*

Background: Little Nogales Spring is located in the upper portion of the Wakefield Canyon drainage, about 10 km upstream of the confluence with Cienega Creek. Department and BLM staff stocked 910 Gila Topminnow in May 2012. The topminnow originated from Cienega Creek. During the July 2013 monitoring, no topminnow were captured, and flooding had scoured the stocking pools. No fish were captured during monitoring in 2014 and 2015. The stream has a relatively high gradient (4.8% from the spring to confluence with Nogales Spring) and appears to be highly susceptible to high flow events with little cover, limiting the ability of Gila Topminnow to persist in this system. Department staff recommended that no more Gila Topminnow be stocked and that it be removed from the list of potential repatriation sites (Mosher et al. 2016).

Results: Department staff monitored for Gila Topminnow at Little Nogales Spring on August 23, 2016. They set 10 minnow traps, but no fish were captured. One Sonora mud turtle was observed. Little Nogales Spring was removed as a Gila Topminnow repatriation site in 2015; however, due to its close proximity to Nogales Spring, it was monitored in 2016.

Recommendations: This was the fourth year of post-stocking monitoring with no Gila Topminnow collected, so the species is considered extirpated from Little Nogales Spring. As mentioned in a previous report, flooding and high gradient were thought to be the main cause of extirpation (Love-Chezem et al. 2015). No additional stockings or monitoring are recommended. However, this location may be suitable for Longfin Dace.

Work Planned for 2017: None because Gila Topminnow failed to establish.

#### *Las Cienegas National Conservation Area-Nogales Spring*

Background: Nogales Spring is located in the upper portion of the Wakefield Canyon drainage, about 10 km upstream of the confluence with Cienega Creek. Department and BLM staff stocked 833 Gila Topminnow in May 2012. Nogales Spring was visually surveyed by AGFD and BLM staff on July 10th, 2012, who observed about 50-100 large and 50 small Gila Topminnow. However, no fish were seen or captured during monitoring in July 2013. Habitat looked suitable in pools downstream, so Department staff stocked 485 more Gila Topminnow in August 2013. However, only three were captured in August 2014, and none in July 2015. The site appeared to have suitable habitat and was subsequently stocked with 612 Gila Topminnow in August 2015. If fish do not establish, Nogales Spring should be removed as a potential repatriation site or environmental characteristics (water quality and canopy cover) should be evaluated to determine if they are preventing Gila Topminnow establishment.

Results: Department staff monitored for Gila Topminnow at Nogales Spring on August 23, 2016. They set 10 minnow traps and captured 5 Gila Topminnow (>20 mm).

Recommendations: Gila Topminnow were stocked in 2012, 2013, and 2015, therefore monitoring should continue until at least 2018.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Nogales Spring.

#### *Las Cienegas National Conservation Area-Spring Water Wetland*

Background: Spring Water Wetland is located just east of Cienega Creek about 0.4 km upstream of the confluence with Spring Water Canyon. Department and BLM staff stocked 674 Gila Topminnow in May 2013; the fish were acquired from Cienega Creek. Over 8,000 Gila Topminnow were captured during monitoring in 2014, and over 1,000 were captured in 2015.

Results: On August 23, 2016, Department staff monitored the Gila Topminnow Population at Spring Water Wetland. They set 10 minnow traps and captured 12,112 Gila Topminnow (6,427 were >20 mm, 3,184 were ≤20 mm, and 2,532 were not classified to size).

Recommendations: This was the third year of post-stocking monitoring, so based on catch over that period, Gila Topminnow are considered established at Spring Water Wetland. No further stockings are necessary, except occasionally to maintain genetic variability. Responsibilities for monitoring of this site should go to another AGFD program or other agency (e.g., BLM).

Work Planned for 2017: None because Gila Topminnow are considered established.

#### *Hidden Water Spring*

Background: Hidden Water Spring is located in Cane Spring Canyon, about 0.6 km upstream of the confluence with Cottonwood Creek which flows into Saguaro Lake. Gila Topminnow were stocked into Hidden Water Spring in 1976 and 1981. Gila Topminnows were detected in 2010, but then not in 2011, 2012, or 2013. Therefore, Department staff recommended augmenting the population.

Results: On July 22, 2016, Department and Tonto National Forest staff stocked 544 Gila Topminnow into Hidden Water Spring. A total of 438 Gila Topminnows were stocked into the upper pool and 106 into the lower pool. Fish behaved normally upon release; however, there were 5 mortalities during translocation. Gila Topminnows were collected earlier in the day from the Phoenix Zoo (Lower Santa Cruz lineage).

On August 4, 2016 Department, USFWS, and USFS staff visited Hidden Water Spring to discuss potential road closure and effects that could have on stocking and monitoring of native fish in the spring. Gila Topminnow were observed in the stocking locations (data on estimated numbers was not recorded).



Recommendations: Because Hidden Water Spring was just stocked in 2016, monitoring will continue until at least 2019. Additional topminnow will be stocked if necessary to help establish the population.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Hidden Water Spring and stock more if deemed necessary.

#### *Robbins Butte Wildlife Area-Stop Sign Tank*

Background: Robbins Butte Wildlife Area is located southwest of Buckeye, south of the Gila River and just west of Highway 80. Stop Sign Tank is located just north of the entrance road, and about 2.1 km west of Highway 80. Department staff stocked 571 Gila Topminnow in April 2010. The fish were acquired from Deer Valley High School (Bylas Spring lineage), and Desert Harbor High School (Redrock Canyon lineage).

Department staff monitored the Gila Topminnow in the pond during November 2010, June 2011 and June 2012, and captured over 4,000 topminnow each time, so topminnow were considered established (Pearson 2013). Over 1,000 were captured in June of 2013 for an experiment at ARCC. However, Department staff visited the site in 2014 and did not capture or see any fish. The same was true in nearby Swimming Pool Pond. The Wildlife Area Manager reported that the pond was very green with algae and that boy scouts had removed cattails from the pond, and it was cloudy the day of removal. Too much sediment may have been kicked up and caused the pond to go anoxic, killing all of the fish. Department staff recommended that water be pumped into the pond on a more regular basis to improve conditions for fish. Department staff also planned to restock Gila Topminnow into the pond. In August 2015, Department staff collected Sharp Spring lineage of Gila Topminnow from AD Wash, Buckhorn Spring, and ASU Animal Care Facility and stocked 554 into Stop Sign Tank.

Results: On April 6, 2016, Department staff monitored Stop Sign Tank at Robbins Butte Wildlife Area. Staff set 10 minnow traps and one Gila Topminnow (>20 mm) was captured.

On July 6, 2016, the Department's Aquatic Wildlife Branch staff monitored Stop Sign Tank. Seven minnow traps were set, but no fish were captured. However, two Gila Topminnow were observed in the pond.

Because so few topminnow were observed on the previous two trips, Department staff stopped by the pond on August 29, 2016 after collecting Desert Pupfish from Cottonwood Tank for translocation. Staff observed 50-100 Gila Topminnow in Stop sign Pond.

Recommendations: Gila Topminnow were restocked into Stop Sign Tank in 2015 after they were extirpated, likely because of poor water quality. Gila Topminnow are persisting in Stop Sign

Tank, but in low numbers. The site should be monitored the topminnow until at least 2018, and more stocked if necessary to establish the species. Department staff recommended that the Area Manager add water to the pond more often to help improve water quality.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Stop Sign Tank and stock more if deemed necessary.

#### *Robbins Butte Wildlife Area-Swimming Pool Tank*

Background: Robbins Butte Wildlife Area is located southwest of Buckeye, south of the Gila River and just west of Highway 80. Swimming Pool Tank is located near the headquarters. Department staff stocked 639 Gila Topminnow in November 2009. The fish were acquired from ARCC and were Sharp Spring lineage.

Department staff monitored the Gila Topminnow in the pond during November 2010, June 2011 and June 2012, and captured over 4,000 topminnow each time, so topminnow were considered established (Pearson 2013). However, Department staff visited the site in 2014 and did not capture or see any fish. The Wildlife Area Manager reported that the pond had been drawn down most of the way during maintenance of an adjacent road. Afterwards water was not added and conditions became unsuitable for the fish. Department staff recommended that water be pumped into the pond on a more regular basis to improve conditions for fish. Department staff also planned to restock Gila Topminnow into the pond. In August 2015, Department staff collected Sharp Spring lineage of Gila Topminnow from AD Wash, Buckhorn Spring, and ASU Animal Care Facility and stocked 558 into Swimming Pool Tank.

Results: On April 6, 2016, Department staff monitored Swimming Pool Tank. Five minnow traps were set in Swimming Pool Tank and 91 Gila Topminnow (>20 mm) were captured.

On July 6, 2016, the Department's Aquatic Wildlife Branch staff visited Swimming Pool Tank and observed several thousand Gila Topminnow ( $\leq 20$ mm). On September 16, 2016 the same Department staff collected 647 Gila Topminnow and translocated them to San Rafael Cattle Company's Pasture 9 Tank.

Recommendations: Gila Topminnow was restocked into Swimming Pool Tank in 2015; the species was extirpated before that by an excessive water drawdown. Department staff recommended that the Area Manager should keep water levels in the tank high at all times, and periodically allowed some out flow to improve water quality. Even though it was only one year after stocking, Gila Topminnow appears to be establishing in Swimming Pool Tank. Swimming Pool Tank should be monitored for two more years under the Program.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Swimming Pool Tank.

### *Rock Spring.*

Background: Rock Spring is located in the Mazatzal Mountains within the Tonto National Forest about two miles west of Highway 87 near Sunflower, Arizona. The spring is in the stream bed and produces about a 0.25 km perennial stream immediately downstream; the remaining section of stream is intermittent or ephemeral (Bahm and Carter 2007). In the perennial section of the stream, two pools are located above and three pools below a 1.5 m tall dam. The perennial portion is fenced with a four-strand barbed wire fence to exclude livestock and protect habitat. Gila Topminnow (lower Santa Cruz River lineage) were initially stocked in Rock Spring (above and below the dam) in 2013, and later augmented below the dam in 2014 (Frear et al. 2015). Department staff captured 49 Gila Topminnow in October 2013, 130 in August 2014 and 53 in June 2015; both size classes ( $\leq 20$  mm TL, and  $> 20$  mm TL) were captured each time (Frear et al. 2015; Mosher et al. 2016).

Results: On July 25, 2016, Department staff monitored Rock Spring. Ten minnow traps were set, and six dip net sweeps and one seine haul were performed. Seven hundred ninety-four Gila Topminnow (453 were  $>20$  mm, 341 were  $\leq 20$  mm), 8 Longfin Dace, and 3 Sonoran mud turtles were captured. In addition, about 150 Gila Topminnow and 4 Sonora Mud Turtles were also observed.

Recommendations: Rock Spring was stocked in 2013 and 2014, so monitoring needs to continue until 2017. Gila Topminnow will likely establish at Rock Spring.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Rock Spring.

### *Sabino Canyon*

Background: Sabino Canyon is located northeast of Tucson, Arizona within the Coronado National Forest and Sabino Canyon Recreation Area. Sabino Creek, a tributary to the Santa Cruz River, flows southwest through Sabino Canyon and empties into Tanque Verde Wash within Tucson. Sabino Creek was chemically treated in 1999 to remove nonnative Green Sunfish, and afterwards was stocked with Roundtail Chub<sup>1</sup> (Ehret and Dickens 2009). On August 19, 2015, Department, USFS, and USFWS staff stocked 510 Gila Topminnow into Sabino Canyon near The Crack. Gila Topminnow were collected the previous day from Cienega Creek and Road Canyon Tank (Cienega Creek lineage).

Results: On June 28, 2016, Department staff monitored Sabino Canyon. Nineteen minnow traps were set between the stocking location (The Crack) and Tram Stop 8 and 67 Gila Topminnow

---

<sup>1</sup> Chub in Sabino Canyon were previously classified as Gila Chub.

(37 were >20 mm, 30 were <20 mm), 1,480 Roundtail Chub<sup>1</sup>, and 1 Sonora Mud Turtle were captured. Several pairs of breeding Sonoran Desert Toads were also present throughout this section. In addition, five collapsible minnow traps were set and 3 dip net sweeps were performed in two pools near Tram Stop 7 and 5 Gila Topminnow ( $\leq 20$  mm) and 343 Roundtail Chub were captured. Visual surveys in this area also detected about 20 Gila Topminnow. Visual surveys and seven dip net sweeps were also performed near Tram Stops 2, 3, and 4; however, only Roundtail Chub were captured (13 were  $\leq 50$  mm) and observed.

On August 30, 2016, Department, AGFD Region 5, and BLM staff stocked 985 Gila Topminnow into Sabino Canyon. All fish were stocked into an area of Sabino Canyon known as The Crack. Fish behaved normally upon release; however, there were 24 mortalities during translocation. Gila Topminnow were collected earlier in the day from Road Canyon Tank (Cienega Creek lineage).

Recommendations: Gila Topminnow were stocked into Sabino Canyon during 2015 and 2016, and based on monitoring in 2016, they are persisting. Monitoring will occur until at least 2019. Additional stockings may be necessary to help the species establish.

The reach of Sabino Canyon between East Fork Sabino and West Fork Sabino Canyon should be assessed during the driest period of the year to determine if there are any perennial pools suitable for Gila Topminnow. This upper reach is low gradient and regional staff indicated some pools were present. If habitat is suitable, the Department should consider stocking Gila Topminnow in that reach.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Sabino Canyon, and may stock more if fewer than 100 are captured. Department staff will also assess if there is suitable habitat for Gila Topminnow, chub, and other native fish species in the reach between East Fork and West Fork Sabino Creek during June.

#### *San Pedro Riparian National Conservation Area-Ben Spring*

Background: Ben Spring is located within an unnamed tributary of the Babocomari River, about 1.2 miles west of Fairbank, AZ. The spring fills three small bedrock pools (total surface area about 9.5 m<sup>2</sup>). Department and BLM staff stocked 108 Cottonwood Spring lineage of Gila Topminnow in October 2011. The topminnow were obtained from ARCC. During subsequent monitoring, 10 topminnows were captured in May 2012, but then none were captured in July 2013. In a report on 2014 activities, Department staff recommended that no more topminnow be stocked because habitat was insufficient (Love-Chezem et al. 2015b).

---

<sup>1</sup> Chub in Sabino Canyon were previously classified as Gila Chub.

Results: Department staff monitored for Gila Topminnow at Ben Spring on August 8, 2016. They performed two seine hauls but did not capture or observe any fish.

Recommendations: This was the third post-stocking survey in which no fish were captured or observed. Therefore Gila Topminnow are considered to have failed to establish and extirpated from the site. No further stockings are recommended because habitat is insufficient.

Work Planned for 2017: None because Gila Topminnow failed to establish.

#### *San Pedro Riparian National Conservation Area-Horse Thief Draw*

Background: Horse Thief Draw is a tributary of the San Pedro River, located about 1.2 km north of Highway 80 and 1.3 km west of the San Pedro River. It has about 300 m of perennial water, consisting of shallow runs and glides with interspersed pools, and mixed substrate of cobble, gravel, sand, and clay. Department and BLM staff stocked 519 Desert Pupfish in August 2011. The fish were obtained from Phoenix Zoo and Desert Botanical Garden. On October 20, 2011 Department and BLM staff stocked 381 Gila Topminnow, which were Cottonwood Spring lineage and were acquired from ARCC. During monitoring in September 2012, one Desert Pupfish and one Gila Topminnow were captured, and in July 2013 two Desert Pupfish were captured and eight were observed but no Gila Topminnow were captured or observed. Department staff recommended augmentations of each species. In September 2013, an additional 324 Desert Pupfish and 389 Desert Pupfish were stocked. However, during monitoring in August 2014, only three Gila Topminnow and no Desert Pupfish were captured. In July 2015 no fish were captured or observed (Mosher et al. 2016). Flooding was noted to have changed the habitat in 2014 (Love-Chezem et al 2015b): most of the stocking pools were filled in with sediment and the head cut at the Gila Topminnow stocking location had advanced upstream.

Results: Department staff monitored for Gila Topminnow and Desert Pupfish at Horse Thief Draw on August 22, 2016. They performed six seine hauls and three dip net sweeps but did not capture or observe any fish.

Recommendations: This was the third survey after the last stocking event, and the last time that fish were captured or observed was in 2014, when three Gila Topminnow were captured. Therefore, we consider Gila Topminnow to have failed to establish at this site. However, one more survey will need to be performed to conclude that the species is extirpated. Desert pupfish are considered to have failed to establish and extirpated from the site. As mentioned in a previous report, flooding and sediment deposition obliterated all pools, greatly decreasing the quality of habitat for fish (Love-Chezem et al. 2015b). This site should be removed from further consideration as a repatriation site for Gila Topminnow or Desert Pupfish.

Work Planned for 2017: Department staff will survey fish in Horse Thief Draw.

*San Pedro Riparian National Conservation Area-Little Joe Spring*

Background: Little Joe Spring is located 7 km southwest of Saint David and about 1.2 km west of the San Pedro River. Little Joe Spring feeds a pond that is fenced to exclude livestock and bullfrogs. Department and BLM staff stocked 858 Desert Pupfish in May 2013; fish were acquired from McDowell Mountain Regional Park's Nursery Tank, and the Arizona Trails Pond and Mandarin Pond at Phoenix Zoo. During monitoring in August 2014, Department and BLM staff captured 553 Desert pupfish, and in July 2015 captured 259 Desert Pupfish.

Results: Department staff monitored for Desert Pupfish at Little Joe Spring on August 8, 2016. Department staff set 10 minnow traps and performed five dip net sweeps and captured 812 Desert Pupfish (757 were >20 mm, 55 were ≤20 mm). About 100 Desert Pupfish were also visually observed.

Recommendations: Desert Pupfish at Little Joe Spring have increased in abundance since their initial stocking in 2013 and their overwintering population likely exceeds 500 individuals. Recruitment has also been detected during each annual monitoring effort. Therefore, Desert Pupfish are considered established at Little Joe Spring. Future stockings, for genetic maintenance, and monitoring can be performed by other AGFD programs (Native Aquatic Program or Region V Fisheries Program), or monitoring could be performed by another agency. Status of the populations should be reported to AGFD, Reclamation, and USFWS.

Work Planned for 2017: None because Desert Pupfish are considered established in Little Joe Spring.

*San Pedro Riparian National Conservation Area-Murray Spring*

Background: Murray Spring is an east flowing tributary of the San Pedro River. A perennial section begins about 2.8 km west of the San Pedro River and extends about 1.6 km through a cienega and has pools, runs, and glides. A wastewater facility exists about 1.8 km upstream and likely provides groundwater input to Murray Spring. About 1.5 km upstream from the confluence with the San Pedro River, is a concrete barrier that seemingly prevents nonnative fishes from moving upstream.

On August 25, 2011 Department and BLM staff stocked 1,002 Desert Pupfish; fish were acquired from the Phoenix Zoo and Phoenix Botanical Garden. A couple months later, on October 20, they stocked 401 Gila Topminnow, which were of the Cottonwood Spring lineage and were acquired from ARCC. During the first post-stocking monitoring in May 2012, Department and BLM staff captured 10 Gila Topminnow and 21 Desert Pupfish. The monitoring was done at the beginning of the breeding season, so the population was expected to

grow. However, during the next annual monitoring in July 2013, no topminnow and only two Desert Pupfish were captured. Therefore Department staff recommended an augmentation stocking. In September 2013, 712 more Desert Pupfish (from TNC Lower San Pedro River Preserve) and 383 Gila Topminnow (from ARCC) were stocked. During monitoring in August 2014, six Gila Topminnow and 2 Desert Pupfish were captured. Staff noted evidence of large scale flooding; cattails in the center of the drainage were laid flat, and debris was piled on the upstream side of trees (Love-Chezem et al. 2015b). However the habitat still appeared suitable for both species, so an additional stocking was recommended. A third stocking was completed in October 2014 when 298 Desert Pupfish and 496 Gila Topminnow were stocked. During the next monitoring in July 2015, eight Gila Topminnow and 5 Desert Pupfish were captured. Cattails were dense and very little pool habitat was found (Mosher et al. 2016).

After the 2015 monitoring, Department staff recommended improvements to Murray Spring (Mosher et al. 2016). The barrier is eroding so should be improved to prevent further upstream movement of nonnative fish. Stream channel improvements could decrease sediment loads and increase pool habitat for Gila Topminnow and Desert Pupfish. Longfin Dace are becoming abundant, so they should be trapped and moved below the barrier to help Gila Topminnow and Desert Pupfish establish viable populations.

Results: Department staff monitored for Gila Topminnow and Desert Pupfish at Ben Spring on August 8, 2016. They set eight minnow traps and performed six dip net sweeps between Murray Springs and the pipeline barrier. A total of 79 Longfin Dace (76 were >20 mm, 2 were ≤20 mm) were captured. Two minnow traps were set below the pipeline barrier and 111 Longfin Dace (100 were >20 mm, 11 were ≤20 mm), 3 Western Mosquitofish (>20 mm), 1 Fathead Minnow (>40 mm), and 2 Northern Crayfish *Orconectes virilis* were captured.

Recommendations: Because the last Gila Topminnow stocking was in 2014, Department staff will monitor for Gila Topminnow and Desert Pupfish at least one more time. We think that consideration should be given to stocking a different lineage, or a mix of lineages of Gila Topminnow, because the Cottonwood Spring lineage seems to take longer to increase in abundance than other lineages. However, the cattails have greatly expanded in the stream bottom, and very few pools are left, so habitat quality seems to have decreased and Longfin Dace are present to compete with topminnow.

Work Planned for 2017: Department staff will monitor fish in Murray Spring. Another lineage of Gila Topminnow will be stocked in a further attempt to establish the species.

### *Sheepshead Canyon*

Background: Sheepshead Canyon is located within the Coconino National Forest north of Cornville, Arizona. Perennial water begins below a dry waterfall about 1.84 km upstream of the

creeks' confluence with Oak Creek. The perennial section of the creek is comprised of a network of channels, pools, and wetlands that are maintained by ground water discharge from numerous springs and seeps within the drainage. A diversion ditch is located about 0.6 km downstream of the dry waterfall and flows southeast to private property in Cornville. In September 2014, 819 Gila Topminnow (Middle Santa Cruz River lineage) were stocked into Sheepshead Canyon: 336 in the pool below the dry waterfall and 483 into the pool above the diversion ditch (Mosher et al. 2016). During monitoring in June 2015, only two Gila Topminnow were captured. An additional 511 Gila Topminnow were stocked in June 2015 immediately after the monitoring.

Results: On September 12, 2016, Department staff set five minnow traps in the upper pool at Sheepshead Canyon. Two Gila Topminnow (>20 mm, both were mortalities) and five Sonora mud turtles were captured. An additional five Gila Topminnow were also observed in the upper pool. Five minnow traps were set in the lower pools above and below the drainage ditch. Two Northern Crayfish were captured but no fish were captured or observed.

During the augmentation stocking on October 18, 2016, Department staff visually observed about 200 Gila Topminnow of both size classes in the upper most stocking pool. Despite low numbers of fish detected during formal monitoring efforts, it appears that Gila Topminnow are establishing at Sheepshead Canyon.

On October 18, 2016, Department staff stocked 656 Gila Topminnow into Sheepshead Canyon. A total of 216 Gila Topminnow were stocked into the pool below the dry waterfall, 79 into the middle pool, 207 into the pool above the drainage ditch, and 154 into the pool below the drainage ditch. Fish behaved normally upon release; however, there were seven mortalities during translocation. Gila Topminnow were collected earlier in the day from the Phoenix Zoo (Lower Santa Cruz lineage).

Recommendations: Gila Topminnow were stocked in 2014, 2015, and 2016, so monitoring needs to continue until at least 2019. We recommend postponing any additional stockings to establish Gila Topminnow. About 1990 fish were stocked, but catch of fish during monitoring has been low. Habitat may be limiting the ability of the species to establish. The upper pool is right below a waterfall, so does not receive sunlight all day, and is subject to turbulence when floods flow over the waterfall. The largest of the three downstream pools has a surface area of about 13 m<sup>2</sup> and has the best habitat but is the one below the diversion ditch. When water is diverted into the ditch for long periods, the pool below it likely shrinks.

Work Planned for 2017: Department staff will monitor Gila Topminnow in Sheepshead Canyon.

*Walnut Spring (#392)*



Background: Walnut Spring is located in the foothills of the Sierra Ancha Mountains within the Tonto National Forest about 7 miles east of Punkin Center, Arizona. The spring fills a small, earthen pond and water exiting the pond flows downstream to form cienega-like habitat until it reaches an ephemeral section of Walnut Creek. The spring, tank, and a small portion of stream are fenced to exclude livestock and protect riparian habitat. Cattail and blackberry are abundant around the tank and vegetation removals were conducted in 2007 and 2014 to improve Gila Topminnow habitat (Frear et al. 2014). Red Swamp Crayfish *Procambarus clarki* are present in the pond and mechanical removals have occurred since 2008 to control this nonnative species. Northern Crayfish were also present in the pond before 2013, but appear to have been fully replaced by Red Swamp Crayfish.

Department staff stocked 71 Gila Topminnow (Redrock Canyon lineage) in October 2012; topminnow abundance at the source population, Desert Harbor Elementary School, was low at the time (Frear et al. 2014). Because of the low number stocked, augmentations were planned. Department staff monitored Walnut Spring on July 24, 2013 and captured four Gila Topminnow. After monitoring, 347 Gila Topminnow were stocked; these were obtained from ASU Animal Care Facility and Desert Harbor Elementary School. The second annual post-stocking monitoring was completed on July 19, 2014. A total of 410 Gila Topminnow and about 315 Red Swamp Crayfish were caught and hundreds of both size classes of topminnow were observed. On June 30, 2015, Department staff performed the third annual monitoring, and captured 990 Gila Topminnow and 160 Red Swamp Crayfish. In addition, thousands of Gila topminnow of both size classes and sexes were observed (Mosher et al, 2016).

Results: On June 30, 2016, Department staff monitored Walnut Spring (#392). Ten minnow traps were set and two dip net sweeps were performed. A total of 75 Gila Topminnow (67 were >20 mm, 1 was ≤20 mm, 7 were mortalities) and 239 Red Swamp Crayfish were captured. About 50 Gila Topminnow (>20 mm) were also visually observed. Sixty of the captured Gila Topminnow were translocated from the site for a fish health assessment.

Gila Topminnow have likely established at Walnut Spring (#392). Low Gila Topminnow catch rates in 2016 are likely an artifact of Red Swamp Crayfish consuming Gila Topminnow during sampling. Previous surveys had shorter trap set times and/or Red Swamp Crayfish were continuously removed from traps during sampling.

Recommendations: Walnut Spring was stocked in 2012 and 2013, so the site has been monitored three times since the last stocking. Even though less than 100 topminnows were captured in 2016, in previous years over 400 were captured, and each year both YOY and adult fish have been captured. Therefore, we consider Gila Topminnow established in Walnut Spring. Future stockings, for genetic maintenance, and monitoring can be performed by other AGFD programs (Native Aquatic Program or Region V Fisheries Program), or monitoring could be performed by

another agency. Status of the populations should be reported to AGFD, Reclamation, and USFWS. Red Swamp Cray fish prey on topminnow in traps, so traps should be floated during monitoring.

The site still has a couple of threats that need to be addresses. Red Swamp Crayfish inhabit the spring pond, and consideration should be given to a chemical treatment to eradicate them. The spring is also surrounded by blackberry brambles and shrubs which periodically need to be trimmed back to allow access. The spring pond is also full of cattails and bulrush which should be removed at least every two years.

Work Planned for 2017: None because Gila Topminnow are considered established.

### **Arnett Creek repatriations**

#### Recovery Objectives:

- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.

Background: In 1992, the Department, Tonto National Forest, and USFWS identified an opportunity to reestablish a native fish community in Arnett Creek. In the late 1990s, after environmental planning, a fish barrier was built, the stream was chemically treated to remove nonnative fishes, and a few native fish were stocked. Unfortunately those fish did not establish populations, likely because too few were stocked and drought greatly reduced the amount of perennial water in the system.

The partners re-evaluated the stream in 2007, and determined that the small amount of habitat was probably only suitable for Longfin Dace and Gila Topminnow. The plan was to stock Longfin Dace first, and if they established a population, to move forward with Gila Topminnow. Longfin Dace were stocked in 2007, and they did establish. So, planning for stocking Gila Topminnow continued.

During 2010-2015, Department staff surveyed the few tanks and potential perennial reaches upstream of the proposed stocking locations and did not detect any nonnative fish.

Results: Department staff continued to coordinate with Tonto National Forest and USFWS regarding stocking of Gila Topminnow into Arnett Creek and Telegraph Canyon, and associated fencing, removal of invasive plants, and creation of new recreation trails. On April 28, Department staff sent a letter to the grazing allotment permittees regarding the plans to stock Gila Topminnow into the two streams. In early May 2016, Department staff reviewed a draft Biological Assessment for the effects of on-going livestock grazing on the stocking of Gila

Topminnow into Arnett Creek and Telegraph Canyon, and provided comments back to Tonto National Forest. In early August 2015, Department staff reviewed a draft Biological Opinion and provided comments back to USFWS and Tonto National Forest. Department staff completed an Environmental Assessment Checklist in preparation for stocking.

On August 11, 2016, Department staff investigated two potential perennial water locations on Arnett Creek upstream of Telegraph Canyon to ensure Green Sunfish were absent. These locations were surveyed based on previous recommendations from Tonto National Forest staff. The first reach was located near a small mine off of Arnett Creek Rd (NAD83 12S 488917 3679406 to 489077 3679387); the second reach was located near the confluence of Wood Canyon below private property (489545 3679202 to 489712 3678775). They did not detect any perennial water in either of these reaches. The creek had no surface water, except for a few small rainwater puddles. Due to stormy weather and muddy conditions, they were unable to investigate if Wood Canyon had perennial water.

Recommendations: The consultation between Tonto National Forest and USFWS regarding ongoing livestock grazing effects on the Gila Topminnow stocking took longer than expected, and was not completed until December 2016. Because winter was approaching and water temperatures were low, Department staff recommended that stocking of Gila Topminnow be postponed until spring or early summer 2017.

Work Planned for 2017: Department staff will stock Gila Topminnow into Arnett Creek in spring, and perform the 6-month post-stocking monitoring in autumn. More Gila Topminnow may be stocked in the autumn if fewer than 100 are captured during monitoring.

### **Spring Creek (Oak Creek tributary) repatriations**

#### Recovery Objectives:

- Spikedace recovery objective 6.3. Reintroduce Spikedace to selected reaches.
- Spikedace recovery objective 6.4. Monitor success/failure of reintroductions.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.

Background: Spring Creek is a tributary to Oak Creek in the Verde River drainage, and contains Roundtail Chub<sup>1</sup>, Speckled Dace, Longfin Dace, Sonora Sucker, Desert Sucker, and Northern Mexican Gartersnake *Thamnophis eques*. A small diversion dam about 0.95 km upstream of Oak Creek seemingly prevented most nonnative fishes from entering the stream above, but there were some records from the 1970s and 1980s of Smallmouth Bass *Micropterus dolomieu* and Fathead Minnow. Green Sunfish were detected below the diversion dam in 2011, and in May

---

<sup>1</sup> Chub in Spring Creek were previously classified as Gila Chub.

2014 Green Sunfish were captured 2.5 km above the dam. Program and CAMP staff began removal efforts immediately and completed 7 removals in June and July 2014, after which the Department's CAMP staff assumed responsibility of the removal efforts above the dam began immediately and completed an additional 5 days of removal in 2014.

The purpose of this multi-agency project was to protect the existing Spring Creek population of Roundtail Chub<sup>1</sup> and other native aquatic species against possible future upstream incursion of nonnative fishes from Oak Creek and the Verde River. Additional benefits would accrue from securing habitat for stocking Spikedace, Gila Topminnow, and possibly Loach Minnow.

Reclamation finished construction of a fish barrier about 1.1 km upstream from the Verde River in April 2015. On May 11, 2015, Department staff stocked 221 Spikedace, and on August 12, they stocked 668 Gila Topminnow. During the first monitoring in September 2015, Department staff captured three Spikedace, three Gila Topminnow, 74 Roundtail Chub, 22 Longfin Dace, 95 Speckled Dace, 17 Desert Sucker, and one Northern Crayfish.

Results: On September 12, 2016, Department staff completed the annual post-stocking monitoring for Spikedace and Gila Topminnow, and assisted CAMP staff with another Green Sunfish removal effort in the stream. For Spikedace monitoring, two randomly selected and one fixed 100-m transects were backpack electrofished, making a single pass upstream. Species captured in the electrofishing transects included Roundtail Chub, Speckled Dace, Longfin Dace, Desert Sucker, and Northern Crayfish (the latter were not enumerated; Table 5); no Spikedace were captured. However, one Spikedace (died after capture) was captured outside of the transects during the CAMP Green Sunfish removal (see comments). For Gila Topminnow monitoring, 16 collapsible minnow traps were set on U.S. Forest Service property, 6 in the lower section and 10 in the upper section (Table 5). One female Gila Topminnow (>20mm) was captured in the upper Forest Service section near the original stocking location. Other species caught in minnow traps were Roundtail Chub, Speckled Dace, Longfin Dace, Desert Sucker, and Northern Crayfish.

Because so few Spikedace and Gila Topminnow were captured during monitoring, Department staff stocked 67 more Spikedace and 688 more Gila Topminnow on October 18, 2016. The Spikedace were acquired from ARCC, and the numbers stocked were low because that was all that were available.

Recommendations: Because Gila Topminnow and Spikedace were stocked in 2016, and more will likely be stocked in 2017, monitoring should continue until at least 2020. More of each species should be stocked to help them establish populations. Few Spikedace were available for stocking at ARCC in 2016, so hopefully over 500 individuals can be stocked in 2017. However,

---

<sup>1</sup> Chub in Spring Creek were previously classified as Gila Chub.

if no Spikedace or Gila Topminnow are captured for three consecutive years after the final stocking, then consideration should be given to abandoning this site as a recovery stream for these species. Or a different stocking strategy should be considered.

Work Planned for 2017: Department staff will monitor Spikedace and Loach Minnow in Spring Creek during summer or early autumn. Department staff will stock more Spikedace, and may stock more Gila Topminnow if fewer than 100 are captured during monitoring. Department staff will assist the Region II CAMP program with Green Sunfish removal.

Comments: CAMP staff performed a single-pass electrofishing removal through the entire stream length on the two Forest Service sections during September 2016. No Green Sunfish were captured above the constructed fish barrier; one was captured below the new fish barrier. One Spikedace was captured in the lower section of Forest Service property. The Department has now completed 20 removal efforts, and no Green Sunfish have been detected upstream of the fish barrier for the last 8 surveys. Based on removal and monitoring events, it is likely that Green Sunfish have been eradicated from Spring Creek above the barrier. Also, both Spikedace and Gila Topminnow persisted since being stocked into Spring Creek. However, with just one individual of each species captured, little else can be concluded.

### **Mineral Creek drainage renovation and repatriations**

#### Recovery Objectives:

- Gila Chub draft recovery plan objective 2. Ensure representation, resiliency, and redundancy by expanding the size and number of populations within Gila chub historical range via replication of remnant populations within each RU.
- Gila Chub draft recovery plan objective 7. Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.

Background: Mineral Creek is a tributary to the Gila River near Kelvin, Arizona. Fish species previously recorded from the drainage include native Roundtail Chub<sup>1</sup>, Longfin Dace, and Desert Sucker, and nonnative Green Sunfish, Fathead Minnow *Pimephales promelas*, Western Mosquitofish *Gambusia affinis*, and Black Bullhead *Ictalurus melas*. Roundtail Chub<sup>1</sup> was first documented in 1993 (Andrews and King 1997), but was last documented during 2000 (Robinson 2008a) even though five surveys in upper Mineral Creek (upstream of Big Box Dam) were completed between 2002 and 2013: two during 2002, one in 2006, one in 2008, and one in 2013.

---

<sup>1</sup> Chub in Mineral Creek were previously classified as Gila Chub.

Although chub were not captured in a number of surveys, USFWS still considered them extant, and wrote a letter to the landowners in the drainage stating that fact and that stocking more would not change the status of the species in the drainage. Department staff communicated with the landowners (Government Springs Ranch, Arizona State Land Department, and ASARCO Ray Mine), about moving forward with stocking Roundtail Chub in upper Mineral Creek. However, after Governor Ducey was elected, the newly appointed State Land Department commissioner stopped approving wildlife reintroductions on State Land Department properties. The proposed project has been postponed since then.

Results: No work was completed on this priority action during the performance period.

Recommendations: The Department has not yet worked out an agreement with State Land Department relative to wildlife introductions on State Land Department properties. Therefore we recommend that this priority action be dropped from the list. If the Department is able to work out an agreement and gets approval to introduce wildlife, then this project can be added back to the list.

Work Planned for 2017: None because it is not known when the Department will get approval from State Land Department to introduce fish.

### **Blue River native fish restoration**

#### Recovery Objectives:

- Spikedace recovery objective 6.3. Reintroduce Spikedace to selected reaches.
- Spikedace recovery objective 6.4. Monitor success/failure of reintroductions.
- Loach Minnow recovery objective 6.3. Reintroduce Loach Minnow to selected reaches.
- Loach Minnow recovery objective 6.4. Monitor success/failure of reintroductions.

Background: The Blue River Native Fish Restoration Project was implemented by the Department, Forest Service, Reclamation, and USFWS, with goals to protect and restore the entire assemblage of native fishes within the Blue River drainage and benefit their conservation status within the Gila River Basin (Reclamation 2010). The major components of the project were construction of a fish barrier, mechanical removal of non-native fishes, and repatriation and monitoring of federally listed warm-water fishes in the Blue River. The focus of the project was in the lower 19 km of the Blue River, from Fritz Ranch to the confluence with the San Francisco River (Figure 7), but additional activities were envisioned upstream if actions were successful in the lower reach. The Reclamation-funded fish barrier, located in the Blue River about 0.8 km upstream from the confluence with the San Francisco River, was completed in June 2012. Later in the same month, 539 Spikedace and 142 Roundtail Chub were stocked into the lower Blue River above the barrier. Spikedace were upper Gila River lineage and Roundtail Chub were

Eagle Creek lineage and both were acquired from ARCC or were directly translocated from the donor streams to the Blue River. Efforts to remove non-native piscivorous fish from the lower Blue River were done once before barrier emplacement (Robinson et al. 2010) and annually thereafter.

During annual post-stocking monitoring, Spikedace catch rates were relatively flat during 2012 through 2014, but then increased in 2015 (Figure 8). After the 2015 monitoring, 296 more Spikedace were stocked into the lower Blue River. Roundtail Chub catch rates dropped from 2012 to 2013, but then increased in 2014 and increased again in 2015, but 876 more were stocked in 2015 before the monitoring (Figure 8).

Efforts to mechanically remove piscivorous fish seem to be working. Nonnative fish are removed both during removal trips, and during annual post-stocking monitoring of native fishes. Catfish were the main targets of removal efforts, and were removed by snorkeling and spearfishing. During the first removal, in June 2009, 70 Channel Catfish and four Flathead Catfish were removed from the Blue River between Fritz Ranch and the mouth (Robinson et al. 2010). During the June 2012 removal, after the 2011 Wallow Fire related fish kills, and after the fish barrier was constructed, only seven Channel Catfish were captured and removed, but one Green Sunfish was also detected (the first record in the drainage; Robinson et al. 2013). During the November 2012 annual monitoring, no catfish were captured, but 106 Green Sunfish were captured, and removed, throughout the lower Blue River.

In April 2013, Department staff set 87 traps in the reach between Steeple Creek and Fritz Ranch to determine if Green Sunfish had dispersed upstream (Robinson et al. 2014). No Green Sunfish were captured. During the June 2013 catfish removal, only three Channel Catfish were observed and subsequently removed, but 37 Green Sunfish were observed of which 5 were removed. No catfish and six Green Sunfish were detected during annual monitoring in 2013.

In 2014, in addition to the annual snorkeling and spearfishing to remove catfish, two trips to remove Green Sunfish, by trapping and electrofishing, were completed (Robinson and Love-Chezem 2015). During the June 2014 catfish removal, no catfish were detected, but eight Green Sunfish were detected. During the first Green Sunfish removal effort in May 2014, two Green Sunfish were removed from the lower Blue River. During the second Green Sunfish removal, in June 2014, 10 Green Sunfish were removed; no catfish were detected. Five Green Sunfish and no catfish were captured and removed during the October 2014 annual monitoring.

During early June 2015, Department staff set traps in the lower Blue River, and captured and removed nine Green Sunfish (Robinson et al. 2016). Later in June, during the catfish removal, Department staff did not detect any catfish, but did detect seven Green Sunfish. No Green sunfish or catfish were detected during the September 2015 annual monitoring.

To summarize, the number of catfish detected and removed each year has decreased, and was zero for 2014 and 2015. Similarly, the number of Green Sunfish detected during annual monitoring and the total number removed during all activities has decreased since 2012 (Figure 9).

Results: During June 20-22, 2016, Department staff completed the annual large-bodied piscivore removal effort in the lower Blue River. They visited 123 pools or locations that were previously pools. Eighty-three pools were snorkeled, 29 were observed from above water because they were too shallow to snorkel through, and the lowest four pools were dry. No catfish were detected. This is the third year in a row that catfish have not been detected in the lower Blue River. Department staff also observed hundreds of Spikedace (both young of year and adult), Roundtail Chub (most were >100mm), Sonora Sucker, Desert Sucker, and Longfin Dace. They did detect one adult Green Sunfish in a beaver-dam pool in Reach 4 (Mud Spring to Juan Miller Crossing); roughly 1.7 river miles below Juan Miller Crossing. Unfortunately, they were unable to capture the Green Sunfish after multiple spearfishing attempts and an overnight trap set; 2 traps captured 1 Fathead Minnow and 6 Northern Crayfish.

Department staff also set ten traps (5 hoop nets, 5 mini hoop nets) overnight in 10 pools in Reach 2 (Barrier to Pat Mesa tributary; roughly 2.3 to 3.0 km upstream of the barrier); these pools were too turbid to effectively see fish while snorkeling. Traps captured 1 Green Sunfish (245mm), 17 Fathead Minnow, 1 Spikedace, 11 Roundtail Chub, 21 Desert Suckers, 49 Sonora Sucker, and several crayfish. All nonnative species were removed. One trap was not recovered; bear tracks were present around the pool and it appeared that the bear took the trap.

On August 26, 2016, Department staff stocked 1,194 Roundtail Chub in the middle Blue River below the box. The fish originated from ARCC, and were the Eagle Creek lineage.

During October 3-5, 2016, Department staff completed the annual monitoring on the lower Blue River. In hoop nets, they captured 52 Roundtail Chub, 55 Sonora Sucker, and 236 crayfish (Table 6). During electrofishing they captured 431 Longfin Dace, 321 Sonora Sucker, 270 Speckled Dace, 269 Spikedace, 30 Roundtail Chub, 19 Loach Minnow, and 1 Fathead Minnow (Table 7). Catch rates for Spikedace and Loach Minnow appear to have increased from 2014 to 2016, but those for Roundtail Chub in 2016 were similar to 2014, and somewhat less than 2015 (Figure 8). The stocking of Spikedace in December 2015 likely contributed to the increased catch rate in 2016 (Figure 8); a similar pattern seems evident for Roundtail Chub in 2015. Based on examination of length-frequency diagrams, two cohorts of all target species were obvious in 2016, but less so in previous years (Figures 10-12). Also, YOY Roundtail Chub and Spikedace were obvious in 2014, 2015, and 2016, and Loach Minnow in 2015 and 2016. We conclude that Spikedace and Roundtail Chub are in the process or possibly have established in the lower Blue



River. Loach Minnow appear to be recovering in abundance following the fish kill after the 2011 Wallow Fire.

Green Sunfish appear to be decreasing in abundance since they were first detected in 2012, and since the Department started removing them in 2012. The number of Green Sunfish detected during annual monitoring and the total number removed during all activities has decreased since 2012 (Figure 9).

On October 24, 2016, Department staff stocked 390 Loach Minnow (Blue River lineage) into the lower Blue River just above Juan Miller Crossing (NAD83 12S 668021 3685124). All fish survived the trip from ARCC and behaved normally upon release. The purpose of this stocking was to augment the Loach Minnow population in the lower portion of the river.

Recommendations: Continued monitoring of Spikedace and Roundtail Chub in the lower Blue River should continue until at least 2018, and possibly until 2020 if it is unclear they have established based on abundance and size structure. Roundtail chub should be monitored through 2021 in the middle Blue River, between The Box and McKittrick Creek to determine if they have established there. We recommend that Spikedace be stocked below the Box in 2017 to extend their range in the Blue River.

Green sunfish removals should continue and be more frequent until none are captured or observed in 3-5 consecutive trips. Snorkeling through all pools, in addition to trapping, should also continue because snorkeling seems to be the most efficient way to detect Green Sunfish.

Work Planned for 2017: Department staff will perform the annual the snorkeling to remove catfish and trapping to remove Green Sunfish in June. Additional Green Sunfish removals may be implemented depending on how many are captured or observed during June. Department staff will perform the annual monitoring of fishes in the lower Blue River during late summer or early autumn, and will monitor chub in the middle Blue River during the same period. Department staff will stock more Roundtail Chub below The Box if fewer than 100 are captured during monitoring. Department staff will stock Spikedace into the middle Blue River below The Box. Spikedace will either be acquired from the lower Blue River or from ARCC.

### **Miscellaneous stock tank surveys**

#### Recovery Objectives:

- Gila Chub draft recovery plan objective 2.1. Prepare and protect streams appropriate for replications
- Spikedace recovery objective 6.2.3 Assess status of non-native fishes in the watershed.
- Loach Minnow recovery objective 6.2.3 Assess status of non-native fishes in the watershed.

- Gila Topminnow recovery objective 1-214 Remove *Gambusia affinis* and/or other undesirable nonnative fishes from topminnow habitats when detrimental.

Background: The purpose of this action was to survey all stock tanks in stream systems where nonnative fish removal efforts and fish barriers were planned, to determine the sources of nonnative fishes. Stock tank surveys have been completed in the O'Donnell Creek drainage (Ehret and Frederick 2008), Mineral Creek drainage (Crowder and Robinson 2011; Crowder et al. 2014), Blue River drainage (Crowder et al. 2013), and most of the Grapevine Canyon drainage (New River; Robinson 2009), and most of the Sonoita Creek drainage (Ehret and Dickens 2009b). These surveys were typically completed by making several hauls of a large bag seine across the ponds.

Results: No work was planned and therefore no work was completed on this priority action during the performance period.

Recommendations: For 2017, we recommend stock tanks in the Red Tank Draw drainage be surveyed because nonnative fish removal efforts began there in 2016. Tanks with nonnative fish, particularly Green Sunfish and Black Bullhead, need to be identified, so that targeted and systematic removal efforts can be planned and implemented.

Work Planned for 2017: Department staff will survey all stock tanks in the Red Tank Draw drainage.

### **Assess potential repatriation waters**

#### Recovery Objectives:

- Spikedace recovery objective 6.2. Identify river or stream systems for reintroductions.
- Loach Minnow recovery objective 6.2. Identify river or stream systems for reintroductions.
- Gila Topminnow recovery objective 4.12. Survey, evaluate, and select potential sites.
- Gila Chub draft recovery plan objective 2.1. Prepare and protect streams appropriate for replications.

Background: The purpose of this project is to assess waters in the Gila River Basin to determine if they are suitable for repatriations of Spikedace, Loach Minnow, Gila Topminnow, Roundtail Chub, or other native fishes. Below are summaries of each of the waters assessed during 2017, with coordinates provided in Appendix 4 and locations shown in Figure 13.

#### *Bishop Creek:*

Background: Bishop Creek is a tributary to the Agua Fria River north of Black Canyon City, Arizona. The upper reaches of Bishop Creek are on Prescott and Tonto National Forest, and the

lowest reach is on BLM's Agua Fria National Monument. Bishop Creek is largely an ephemeral and intermittent stream, but short perennial sections may exist that could be suitable for native fish repatriations. During a trip on May 23, 2013, BLM staff noticed several fish of an unidentified species, possibly Western Mosquitofish or Longfin Dace, in a pool at coordinates UTM 12S 402322mE, 3788436mN. Department staff decided to visit this pool and determine if it might be suitable for native fish repatriations.

Results: On February 19, 2016, a Department biologist assessed the lower 2.94 km of Bishop Creek. Prior to the trip, he examined satellite images in Google Earth, and only noticed one pool (UTM 12S 402261mE, 3788470mN) that looked like it could be perennial in the lower section; the pool is just east of the overhead major powerlines and about 900 m upstream of the confluence with the Agua Fria River. The Department biologist walked from the Agua Fria River upstream in Bishop Creek to the pool and did not observe any waterfalls that would restrict the upstream movement of nonnative fishes. A baited minnow trap was set in the pool for about 1.5 hours and did not catch any fish, nor were any fish observed. The pool was about 30 m long, an average of 4 m wide and at its deepest about 1.75 m to 2 m. No aquatic vegetation was observed in the pool, so it may go dry in the driest part of the year. He walked up about 2.04 km past that pool, and the bed was mostly dry except for a few places where water was present over basalt bedrock. Department staff thinks that that short section with water goes dry, and again no fish were seen.

Recommendations: The pool just east of the powerlines may go dry, so visiting the site during the driest part of the year would help confirm whether or not it is perennial. If the pool is perennial, it may be large enough to support a viable Gila Topminnow population. However, because there were no waterfalls that might restrict the upstream movement of nonnative fish, we do not recommend this site for repatriations of native fish, unless a barrier was constructed.

Based on an examination of satellite photos, some stretches of riparian trees exist in upper Bishop Creek (on Tonto and Prescott National Forests), between the upper end of FR1981 and the Bishop Spring (UTM 12S 42396mE, 3794157mN) on the Prescott NF. Future assessments of this upper section should be done to determine whether or not suitable habitat for native fishes exists.

### ***Tonto National Forest Sites***

#### ***Grapevine Canyon:***

Background: Grapevine Canyon is a tributary to New River, southeast of Black Canyon City, Arizona, and is located on Tonto National Forest. The site was originally recommended for native fish repatriations by Tonto National Forest biologist. The site was visited twice in 2007 by Department and Tonto National Forest staff. During the first trip, Green Sunfish and Longfin dace were observed in New River just downstream of the confluence with Grapevine Canyon.

During the second trip, the crew electrofished Grapevine Canyon and only captured Longfin Dace. They also identified a waterfall about 460 m upstream of the confluence that would function as a barrier to upstream movement of Green Sunfish. They identified six large pools upstream of the barrier that looked suitable for Roundtail Chub<sup>1</sup> and Gila Topminnow. After the sixth pool there was a large waterfall, above which they observed three more pools, but did not survey any further.

In April 2009, Department staff visited the five of six stock tanks in the drainage above the large waterfall, to determine if any contained nonnative fish. They set minnow traps and gill nets in two of the tanks and did not capture or observe any fish. One tank was dry. Another tank was very small (2 x 2 m) and shallow (<20 cm) and they did not observe any fish there and thought the tank likely would go dry by the summer. The sixth tank (Pothole Tank #4) was about 20 m in diameter and less than 1 m deep, but they did not have time to sample it.

Results: On February 22, 2016, Department staff visually assessed Grapevine Canyon to determine suitability for potential repatriation of Roundtail Chub<sup>1</sup> and Gila Topminnow; they surveyed from its confluence with New River to roughly 1.6 km upstream. Upstream of the small waterfall located about 460 m upstream from the confluence, they identified a reach that was likely perennial which began where the stream changed from east-west orientation to north-south orientation, and extended upstream about 500 m. However, flows are likely reduced during summer. Within the perennial reach, there were 26 pools, 8 cascades, and 4 runs. Substrate was primarily bedrock mixed with cobble and boulder. Pools comprised the majority of the habitat surveyed (50%), followed by cascades (42%), and runs (8%). The largest pool detected was located at the top of the perennial reach (UTM 12S 412735mE, 3766041mN) and is roughly 7 m x 8 m with a depth of 2 m. Department staff thought the habitat was suitable for chub and topminnow; however, the pools are isolated from one another by bedrock/boulder falls, which could potentially restrict upstream movement of fish between pools. No fish were observed while assessing habitat, but one dead leopard frog was detected. Department staff also investigated Cooks Mesa Tank #1, which was not surveyed on previous trips. This stock tank is located northeast of Grapevine Canyon and was about 1 foot deep at the time of the survey. The tank likely dries completely during summer.

Recommendations: The one remaining stock tank (Pothole Tank #4) that was not surveyed should be visited during the driest time of the year, and surveyed to determine presence of any fish. Department staff recommends stocking Gila Topminnow and Roundtail Chub<sup>1</sup> above the lowest waterfall in Grapevine Canyon as soon as Tonto National Forest can complete ESA Section 7 consultation with USFWS relative to livestock grazing on the allotment.

#### *Tortilla Creek:*

---

<sup>1</sup> Chub proposed to be repatriated were previously classified as Gila Chub.

Background: Tortilla Creek empties into Canyon Lake, Arizona both of which are on Tonto National Forest. Upstream of Tortilla Flat is the confluence of Mesquite Creek and Tortilla Creek. In 1986, Gila Topminnow were stocked into a stock tank in an unnamed drainage (Unnamed Drainage, site 68b) of Mesquite Tank drainage and subsequently dispersed into tinajas in the unnamed drainage and Tortilla Creek itself after the dam on the stock tank failed. They have occupied the unnamed drainage 68b site since 1987. The Department's Aquatic Wildlife Branch staff surveyed Tortilla Creek near Tortilla Flat in 2016 and captured Gila Topminnow. They recommended that Tortilla Creek upstream of the confluence with Mesquite Creek, be evaluated to determine if it contained habitat suitable for Gila Topminnow or other native fishes (Timmons and Paulus 2016).

Results: On March 7, 2016, Department staff assessed Tortilla Creek for Gila Topminnow, Roundtail Chub<sup>1</sup>, and Loach Minnow from the confluence of Tortilla Creek and Mesquite Creek to about 4.8 km upstream. Surface flows were present throughout the survey reach; however, the majority of the reach likely goes dry during summer. Habitat appears to be perennial for 0.5 km, near the upper end of the surveyed reach. Within the perennial reach, there were 7 pools, 6 runs, and 2 cascades. Substrate was primarily bedrock, gravel and sand. Run habitat likely turns marshy during dryer months and cattails or reeds were present within the streambed. The largest pool was roughly 10 m x 10 m with a max depth of 3 m. There was also a long, channel-like pool that measured 20 m x 0.5 m with a max depth of 0.9 m. Fathead Minnow (30 individuals) were visually observed within the perennial reach – these were the only fish observed during the survey. One Sonora Mud Turtle was detected 0.6 km upstream from the confluence of Tortilla Creek and Mesquite Creek.

Recommendations: We recommend that Gila Topminnow be stocked into upper Tortilla Creek in 2017. Tonto National Forest staff indicated that this portion of Tortilla Creek is on a vacant grazing allotment, so no ESA section consultation relative to the allotment would be necessary.

#### *South Fork Sheep Creek:*

Background: South Fork of Sheep Creek is tributary to Sheep Creek, which is tributary to the Verde River between Horseshoe Reservoir and Bartlett Reservoir. Sheep Creek and South Fork Sheep Creek drain from the western slopes of the Mazatzal Mountains and are located on Tonto National Forest. Bagley (2002) surveyed Sheep Creek upstream from the Verde River to just past the confluence with South Fork Sheep Creek, and up South Fork 0.3 miles. He reported Longfin Dace, Green Sunfish and crayfish in South Fork Sheep Creek, and the same species plus Red Shiner in Sheep Creek. Department staff examined satellite images and topographic contours of the Sheep Creek drainage in 2013 and identified potential perennial reaches and a potential waterfall in South Fork of Sheep Creek. In January 2014 the Department's Region VI staff surveyed South Fork Sheep Creek down to the confluence with Tournament Canyon and

---

<sup>1</sup> Chub proposed to be repatriated were previously classified as Gila Chub.

then surveyed up Tournament Canyon and did not detect any fish in either system (Burger 2014). They accessed the system from the Mormon Grove Trailhead and then hiked south on The Arizona Trail to a small trail that branched off and crossed South Fork Sheep Creek; the trail met the creek downstream of Upper Sheep Creek Spring. The Region VI staff did not survey downstream to the location of the potential waterfall. Therefore another reconnaissance trip was warranted.

Results: On March 14-15, 2016, Department staff accessed South Fork Sheep Creek following the same route taken by Region VI staff in January 2014, except that they passed by Upper Sheep Creek Spring on their way down to the targeted survey section (the Tournament Canyon confluence to about 2.7 km downstream. They observed what they thought were likely perennial pools just downstream of Upper Sheep Creek Spring. Below Tournament Canyon, surface flows were present throughout most of the reach surveyed, but the entire reach likely goes dry during summer except for a few small pools towards the top of the reach. Traps were set in these perennial pools; however, no fish were captured. Furthermore, no fish were observed during the entire survey. They also did not detect any natural barriers that would prevent upstream movement of fish. Canyon tree frogs were abundant throughout the survey reach and one Gila monster and one black-necked garter snake were detected.

Recommendations: South Fork Sheep Creek immediately below Upper Sheep Creek Spring appears to have perennial pools that may be suitable for Gila Topminnow and Roundtail Chub<sup>1</sup> depending upon shade, elevation, and the extent of the perennial water during dry periods. We recommend that this portion of South Fork Sheep Creek be assessed during late spring to early summer 2017 to verify if the location is perennial and is suitable for Gila Topminnow or other native fishes.

#### *Long Gulch Artesia:*

Background: Long Gulch flows southward into Theodore Roosevelt Lake a few km west of Salome Creek. Long Gulch Artesian is located within Long Gulch about 1 km upstream of Theodore Roosevelt Lake and is on Tonto National Forest. Long Gulch Artesian was identified as a potential repatriation site in the 1999 draft revised Gila Topminnow Recovery Plan (Weedman 1999).

Results: On July 26, 2016, Department staff visited the Long Gulch Artesia area to assess habitat was suitable for Gila Topminnow. They investigated a rainwater catchment (489049mE, 3729958mN), a possible spring (487919mE, 3732399mN), a large above ground tank (487130mE, 3732410mN), and another possible spring (UTM 12S 487009mE, 3732532mN). Most of these areas consisted of small, mucky puddles or concrete tanks that were not suitable for fish. There were also several black or metal pipes transporting water elsewhere from these

---

<sup>1</sup> Chub proposed to be repatriated were previously classified as Gila Chub.

locations. There may be potential for fish habitat at the large, above-ground tank (4m diameter x 2m deep - uncovered), which was slightly overflowing, creating marshy habitat and a small, pool/run area (25m long x 2m wide with a max depth of 0.4m) directly below. Depending upon the permanence of the tank's overflow and the willingness to dig out the area, it could possibly be improved to support Gila Topminnow.

Recommendations: The Tonto National Forest had indicated that this site could be developed into habitat suitable for fish. If that happens, then the Department will consider reevaluate the site, determine if it is suitable for Gila Topminnow, and if so, stock them.

#### *West Fork Pinto Creek:*

Background: West Fork Pinto Creek is a tributary to Pinto Creek, which flows northward into Theodore Roosevelt Lake. West Pinto Creek is entirely on Tonto National Forest, and the reach upstream of the Miles Ranch Trailhead is on Superstition Wilderness. West Fork Pinto Creek was identified as a potential repatriation site in the 1999 draft revised Gila Topminnow Recovery Plan (Weedman 1999).

Results: On October 20, 2016, 1500 m of West Fork Pinto Creek was assessed by Department staff from Miles Ranch Trailhead to 100 m upstream of the 96 Spring drainage. The primary goal of this trip was to assess habitat for Loach Minnow; however, there was no riffle habitat within this portion of the creek. Habitat within two 100-m reaches was assessed and the same reaches were electrofished. Much of the creek within the surveyed reach was dry. About 170 m of continuous water was present in the lower section (UTM NAD83 12S 495059mE, 3700174mN to UTM 12S 494931mE, 37002891mN), and consisted of shallow pools/runs less than 0.4 m deep. This lower section is likely perennial, but portions likely go dry during summer. Within the 100-m backpack electrofishing reach Department staff captured 52 Longfin Dace, 18 Desert Sucker, and 7 Green Sunfish (26 mm to 172 mm total length). Several leopard frogs were also observed. Proceeding upstream from this section, the creek was mostly dry for 650 m until continuous water begins again at UTM 12S 494509mE, 3700130mN and continued about 900 m to Miles Ranch Trailhead. The lowermost portion of this upper reach consisted of shallow pools/runs with many of the runs having grass on the bottom. The upper section had several large pools up to 2.2 m deep that may be suitable for chub depending upon water quality during dry periods (most of the water in the creek was highly turbid or reddish in color). Within the 100-m electrofishing reach in this upper section, Department staff captured 27 Longfin Dace. Department staff attempted to shock the deep pools; however, no fish were captured. They did observe small fish in one of these pools that were likely Longfin Dace. Water quality in the uppermost pool was: Temperature = 18.4C, pH: 7.85, Conductivity = 1442 $\mu$ S, Salinity = 0.72 ppt, Total Dissolved Solids = 1.02ppm, and Dissolved Oxygen = 5.2 mg/L. There were also a couple of potential fish barriers that may prevent the movement of Green Sunfish (unless sunfish are already present in the pools that we were unable to effectively shock). Barrier 1 was a 2-m

tall bedrock fall located above a large pool (11 m x 5 m with a 1.4 m max depth) at UTM 12S 494295N, 3700025E. Barrier 2 was a 2-m tall bedrock chute (angled at 45 degrees) and located above a pool (11 m x 2.5 m with a 2.2 m max depth) at UTM 12S 494192mE, 3700048mN.

Recommendations: Department staff thinks that the portion of the creek surveyed may be suitable for Roundtail Chub<sup>1</sup> dependent upon water quality and pool depths during dryer periods. Department staff recommends revisiting the portion of the creek between 96 Spring and Miles Ranch trailhead during May or June 2017 to better assess the amount of available habitat. Also in 2017, Department staff recommending surveying Pinto Creek upstream of Miles Ranch trailhead in locations where Tonto National Forest Staff indicated they captured Longfin Dace. If locations upstream of Miles Ranch look suitable, then Gila Topminnow should be stocked.

#### *Reavis Creek:*

Background: Reavis Creek is a tributary to Pine Creek which flows into Apache Reservoir. Reavis Creek is located on Tonto National Forest within the Superstition Wilderness. Department staff examined satellite images of Reavis Creek in 2015 and identified several short reaches where water might persist, two of which were associated with large waterfalls downstream of Reavis Ranch.

Results: On November 2, 2016, Department staff assessed habitat in Reavis Creek from the intersection of Reavis Falls Trail to Reavis Falls. Water within the 1,000-m reach was interrupted, consisting mostly of small, isolated pools (0.15 m to 0.7 m max depth), which likely go dry in the summer. Substrate was predominantly bedrock, boulder, and cobble. There were a couple of larger pools (13 m x 5 m with 1.5 m max depth and 13 m x 12 m with 2 m max depth) that could potentially hold chub in between monsoon and winter rains. These pools were about six inches below the high water mark. Three collapsible minnow traps, and 5 collapsible hoop nets were set to determine if fish were already present in the creek. No fish were captured or observed.

Recommendations: Overall, Reavis Creek could potentially hold chub; however, there may be better options in the Superstitions that have more year-round water (i.e., Fish Creek). Department staff recommends that Reavis Creek above the falls be assessed in 2017 to determine if there is fish habitat in that reach.

#### ***Coconino National Forest Sites***

##### *Russel Spring:*

Background: Russel Spring is on Coconino National Forest in the Russel Wash drainage which is tributary to Wet Beaver Creek near Lake Montezuma, Arizona. In early 2016, Coconino National Forest staff recommended the site be evaluated for native fish repatriations.

---

<sup>1</sup> Chub proposed to be repatriated were previously classified as Gila Chub.



Results: On June 8, 2016, Department staff surveyed habitat in Russel Spring to determine suitability for native fish establishment. Department staff surveyed 672 m of stream channel, of which about 59 m had surface water. Flow was almost nonexistent, and there were two glides and one pool (max depth 18 cm), but because it was so shallow, the entire reach could be considered a glide. The stream was narrow (mean width = 0.86 m) and shallow (mean depth = 6.7 cm; maximum depth = 18 cm). Substrate was assessed at 75 points, of which 39% were <1 cm (sand to silt). Of the 25 particles  $\geq 10$  mm, mean substrate size was 62 mm, and embeddedness was 46%. There was very little instream cover (2.5%) and a moderate amount (39%) of overhead riparian cover. The shallow pool was largely covered with filamentous algae (likely *Spirogyra*). Staff made 10 dip net sweeps, each about 0.5 m long, and captured aquatic beetles (Coleoptera), waterstriders (Hemiptera), mayfly nymphs (Ephemeroptera), damselfly nymphs (Zygoptera), and one giant water bug (Belostomatidae). No fish, reptiles or amphibians were captured or observed. Russel Spring has very little potential for fish. The site was purposely visited during June, a dry period to assess the extent of perennial habitat. It appeared that the wetted reach had been decreasing, as the upstream and downstream ends were just mud. Given that the site is at a higher elevation and had very little water, it is likely unsuitable for Gila Topminnow. Nor is it suitable for Spikedace, Loach Minnow, or chub. The only native species that might potentially be able to establish are Speckled Dace and Longfin Dace, assuming pools do not completely run dry.

Recommendations: Department staff recommends that no fish be stocked into Russel Spring.

#### *Home Tank Draw:*

Background: Home Tank Draw is a tributary to West Clear Creek on Coconino National Forest. In autumn 2015, Coconino National Forest staff recommended the stream be evaluated for native fish repatriations.

Results: On July 5, 2016, Department staff visited Home Tank Draw to assess its potential for native fish repatriation. Home Tank Draw was extremely hard to access - the lower section had sheer canyon walls. Staff was able to enter a short section via the small west-most drainage near Buckhorn Ranch, and after going only 260 m, hit an impassible barrier (~30m high). Below the barrier was a large, deep pool roughly 25m long x 25m wide. They attempted to access lower in the drainage, but the walls were too steep. They were able to see a large portion of the creek from the edge of the canyon and there did not appear to be much perennial water, besides the previously mentioned pool. It is unknown if there are other barriers lower down.

Recommendations: Home Tank Draw is likely not worthwhile for native fish repatriations because of the limited amount of habitat, and the close proximity to West Clear Creek which already has a robust native fish assemblage. If it is thought necessary to further assess habitat

and fish presence in Home Tank Draw, Department staff recommends using rappelling gear or finding an alternate route via West Clear Creek.

*Mesquite and Cottonwood springs:*

Background: Mesquite and Cottonwood springs are located on Coconino National Forest in Cottonwood Basin, south of Fossil Creek Road (FR708). Department and Coconino National Forest staff visited Cottonwood and Mesquite springs on March 2, 2011 to assess suitability for Gila Topminnow or other native fish. A few pools were noted in Mesquite Spring and the group recommended visiting the site during the driest time of year (May or June) to determine how much water was available. Cottonwood Spring had very little water and was not recommended for further investigation. In late 2015, Coconino National Forest staff recommended the two springs be reassessed.

Results: On July 6, 2016 Department staff visited Mesquite and Cottonwood springs located south off of Fossil Creek road. The only water at Mesquite Spring consisted of four small pools (0.5 m x 2 m with 0.4 m max depth; 0.75 m x 0.75 m, max depth=0.4m; 0.5 m x 3 m, max depth=0.3 m; 2 m x 1 m, max depth=0.1 m), the lower three of which appeared to be intermittent. They detected Sonoran mud turtle and hundreds of toad tadpoles in these pools. Department staff hiked about 225 m downstream of the confluence of Mesquite and Cottonwood springs, but they did not observe any surface water. Department staff then hiked from the confluence up 530 m to Cottonwood Spring and did not observe any surface water.

Recommendations: Department staff does not recommend stocking any native fish into Mesquite Spring because of the very small amount of habitat. Likewise, because of the lack of water in Cottonwood Spring, Department staff does not recommend any fish stockings there.

*Doren's Defeat Spring:*

Background: Doren's Defeat Spring is located on Coconino National Forest in Doren's Defeat Canyon which is a tributary to Hackberry Canyon, north of Fossil Creek Road (FR708). Department and Coconino National Forest staff visited the spring on March 2, 2011 to assess suitability for Gila Topminnow or other native fish. The stream in the vicinity of the spring was flowing due to snow-melt runoff. The gradient was above 2%, and the habitat was mostly, cascades, runs, riffles and a few small pools. The habitat did not appear to be very suitable for Gila Topminnow, but the group thought the site should be reevaluated during the driest portion of the year. Late in 2014, Coconino National Forest staff recommended that Doren's Defeat be reevaluated for native fish repatriation.

Results: On July 6, 2016, Department staff hiked from Fossil Creek Road upstream in the drainage to Doren's Defeat Spring. The entire stream bed was dry, except for a small pool located about halfway to the spring location. The pool was 15 m x 0.5 m (max depth=0.2 m), and

surrounded by willow, juniper, and cattails. No surface water was observed at the springhead. No fish were observed.

Recommendations: Department staff does not recommend any fish stockings in Doren's Defeat Spring because habitat is insufficient to maintain a population.

#### *Willow Spring*

Background: Willow Spring is located on Coconino National Forest in Hackberry Basin, north of Fossil Creek Road (FR708). Department and Coconino National Forest staff visited the spring on March 2, 2011 to assess suitability for Gila Topminnow or other native fish. There were a couple long pools that looked like they might be suitable for Gila Topminnow, but the group recommended the site be reevaluated during the driest portion of the year to better determine suitability for fish.

Results: On July 6, 2016, Department hiked from Willow Spring downstream to Fossil Creek Road. There was no surface water present at the springhead. The entire stream bed was dry to the confluence with Doren's Defeat Canyon, except for four shallow, intermittent pools between UTM 12S 438157mE, 3811298mN to UTM 12S 438019mE, 3811375mE. Pool dimensions were as follows: 1 m x 1 m (max depth=0.3 m), 2m x 1m (max depth=0.3 m), 3 m x 1 m (max depth=0.3 m), and 4 m x 2 m (max depth=0.3 m). The area separating each pool was either dry or consisted of a marshy run. No fish were observed. Giant water bugs, water striders, and water boatmen were present in the pools.

Recommendations: Because there was so little water in the stream, Department staff does not recommend stocking any fish into Willow Spring.

#### *Big Willow Spring:*

Background: Willow Spring is located on Coconino National Forest in Hackberry Basin, north of Fossil Creek Road (FR708). Department and Coconino National Forest staff visited the spring on March 2, 2011 to assess suitability for Gila Topminnow or other native fish. There was some water near the spring, but the group recommended the site be reevaluated during the driest portion of the year to better determine suitability for fish.

Results: Department staff visited Big Willow Spring on July 6, 2016. Department staff started their survey of Big Willow Spring at the confluence of Willow Spring and Big Willow Spring and ended about 250 m upstream at Big Willow Spring. Surface water was present at UTM 12S 437918mE, 3811607mN to UTM 12S 437933mE, 3811621mN. Surface water consisted of two small pools: 2 m x 2 m (max depth=0.3 m) and 4 m x 1.5 m (max depth=0.3 m). No fish were observed. Giant water bugs and sunburst beetles were present in one of the pools.

Recommendations: Because there was so little water in the stream, Department staff does not recommend stocking any fish into Big Willow Spring.

### ***Coronado National Forest Sites***

#### *Ash Creek*

Background: Ash Creek drains northward off of the Pinaleno Mountains and is tributary to the Gila River, near Pima, Arizona. The upper portion of the creek is on Coronado National Forest, and the lower portion is on state and private land. The Department stocked Apache Trout and then Gila Trout into the high elevation portion of the stream, but the lower portion, near Cluff Ranch might have habitat suitable for other native fish.

Results: On April 12, 2016, Department staff assessed fish habitat in Ash Creek below Cluff Ranch. Habitat was assessed within a 100-m long reach located between UTM NAD83 12S 607829mE, 3632197mN and UTM 12S 607789mE, 3632123mN. Ten cross-sectional transects were placed every 10 m, starting 5 m upstream from the beginning of the reach. Each cross-sectional transects was divided into 10 equal segments, and the midpoints of those segments were the sampling points. At each point, water depth, substrate size, and embeddedness were measured. Substrate sizes were later classified during analysis using a modified Wentworth (1922) scale. Average wetted width ranged between 0.05 m to 3.8 m depending on habitat type with an overall average width consisting of 1.08 m. Average depth ranged between 0.01m to 0.24 m depending on habitat type, with an overall average depth consisting of 0.16 m. Substrate was predominantly sand and silt; however, gravel and pebble were also present at some locations. Overall, this portion of Ash Creek does not appear to have suitable habitat for Loach Minnow; however, it may provide suitable habitat for Longfin Dace and Gila Topminnow if the section does not go dry.

Recommendations: Department staff does not recommend stocking Spikedace or Loach Minnow into the portion of Ash Creek surveyed. The same section should be resurveyed during the driest time of the year to determine if the habitat is still suitable for Gila Topminnow. Cluff Reservoir No. 3 contains nonnative warm-water sport fish, and is located upstream of the portion of Ash Creek surveyed. Before any native fish are considered for stocking into Ash Creek, the likelihood of nonnative fish escaping into the stream should be determined.

#### *Deadman Canyon*

Background: Deadman Canyon drains northward off of the Pinaleno Mountains and is tributary Graveyard Wash which is tributary to the Gila River, near Safford, Arizona. The upper portion of the creek is on Coronado National Forest, and the lower portion is on private land. Department staff completed a GIS analysis (unpublished) of all perennial streams in the Gila River basin to identify reaches that potentially may be suitable for Spikedace and Loach Minnow based on gradient, Shreve stream order, and elevation at reaches that were historically occupied

by the two species. A canal off of Deadman Creek near Deadman Mesa was identified as potential habitat. Also, Department staff examined satellite images and identified some segments with riparian trees where perennial water may exist in the lower elevations of Deadman Creek near Deadman Mesa. This reach was targeted as potential habitat for Loach Minnow, Roundtail Chub<sup>1</sup>, and Gila Topminnow.

**Results:** On April 12, 2016, Department staff surveyed Deadman Canyon for to determine if habitat was suitable for Loach Minnow or other native fishes. The canal turned out to be a water pipeline, so was not surveyed. Instead, Department staff surveyed a 100-m reach above the diversion pipeline in a presumed perennial section of water. At UTM NAD83 12S 611398mE, 3623118mN, we set a temperature logger and started the 100-m reach to measure microhabitat. Ten cross-sectional transects were placed every 10 m through the habitat site, starting 5 m upstream from the beginning of the site. Each transect was divided into 10 segments, and midpoints of those were sampled. At each point, water depth, substrate size, and embeddedness were measured. Substrate sizes were later classified during analysis using a modified Wentworth (1922) scale. Habitat type varied, but consisted primarily of cascade-riffles and runs. Wetted width ranged between 1.1 m to 4.7 m depending on habitat type with an overall average wetted width consisting of 2.9 m. Average depth ranged between 0.06 m to 0.23 m depending on habitat type, with an overall average depth consisting of 0.12 m. Substrate was predominantly boulder; however, pebble and cobble were also present at some locations. Average embeddedness ranged from 0% to 70% with an overall average embeddedness of 19%. Overall, this portion of Deadman Canyon does not appear to have suitable habitat for Loach Minnow based on the predominate substrate size (boulder) and habitat type (cascade/cascade-riffle); however, it may provide a small amount of suitable habitat for chub depending upon the depths of runs and cascade-pools during dry periods. Once we retrieve the temperature logger data, we will have a better idea of the amount of perennial water available in this section.

**Recommendations:** Department staff recommends that the stream be re-assessed during a drier time of the year in 2017, and that the temperature logger be retrieved.

#### *Sabino Canyon:*

**Background:** Sabino Creek in Sabino Canyon drains the southern slopes of the Santa Catalina Mountains, and is a tributary to Tanque Verde Wash in Tucson, Arizona. Sabino Creek has perennial reaches in the Sabino Canyon Recreation Area and in Pusch Ridge Wilderness, both of which are in Coronado National Forest. Department, Coronado National Forest, and USFWS staff stocked 510 Gila Topminnow into Sabino Creek, in the upper portion of the recreation area, in August 2015. However, Department staff examined satellite images and thought there might be suitable areas further upstream to stock Gila Topminnow and possibly other native fish

---

<sup>1</sup> Chub considered for repatriation were previously classified as Gila Chub.

species. They recommended evaluating the stream upstream of the boulder barrier (UTM 12S 520551mE, 3579167mN), below which Roundtail Chub<sup>1</sup> were originally stocked.

**Results:** On June 28, 2016 Department staff assessed the portion of Sabino Canyon from the boulder barrier where Gila Chub was originally stocked to roughly 700 m upstream where the canyon walls narrow. Most of the habitat in this reach consists of small, shallow intermittent pools; however, there were several larger, deeper pools (>1 m deep) scattered throughout. The largest two pools were located at the end of the reach and measured 24 m x 21 m (2 m max depth) and 21 m x 20 m (2 m max depth). No fish were observed in the surveyed reach; canyon tree frogs were abundant. Department staff thought there was suitable habitat for chub, Desert Sucker, and Speckled Dace, to persist in this section of Sabino Canyon during the dry summer months. The section evaluated was narrow and may be prone to high flows, so may be less suitable for Gila Topminnow.

**Recommendations:** Department staff recommends that the reach of Sabino Creek between East Fork Sabino Creek and West Fork Sabino Creek be evaluated during a dry period in 2017 to determine if that reach might be suitable for Gila Topminnow, Roundtail Chub<sup>1</sup>, and other native species.

**Work Planned for 2017:** Department staff plan to survey habitat to determine suitability for native fish repatriations in the following systems: 1) Copper Creek, tributary to Bishop Creek in the Agua Fria River drainage; 2) Haunted Canyon, tributary to Pinto Creek in the Salt River drainage; 3) West Fork Pinto Creek, in the Salt River drainage 4) Sabino Canyon between East and West Fork Sabino creeks; 5) Buehman Canyon, which drains northeast off of the Rincon Mountains into the San Pedro River; 6) Double R Canyon, tributary to Bass Canyon in the Hot Springs Canyon drainage; 7) Cave Creek in the Chiricahua Mountains; 8) Pigeon, Thomas, Squaw, and Little Blue creeks in the Blue River drainage; 9) Calf Pen and Hardscrabble Creeks in the Fossil Creek drainage; and 10) Deadman Creek, tributary to the Verde River at Horseshoe Reservoir.

## **Aquatic Research and Conservation Center O&M**

### Recovery Objectives:

- Spikedace recovery objective 8. Plan and conduct investigations on captive holding, propagation and rearing.
- Loach Minnow recovery objective 8. Plan and conduct investigations on captive holding, propagation and rearing.

**Background:** Reclamation funded construction of a native fish conservation facility on the grounds of the Department's Bubbling Ponds Hatchery. The main purposes of the facility were

---

<sup>1</sup> Chub in Sabino Canyon were previously classified as Gila Chub.

to develop propagation techniques for Loach Minnow and Spikedace, to establish refuge populations of all of the lineages, and to propagate fish for repatriations. A wet lab was constructed in 2000, a well was installed in 2003 to supply water to the facility, and open-air production and grow-out building was constructed in 2007. Loach Minnow (N=115, from Aravaipa Creek) were first brought into the facility in 2002, to develop propagation techniques (Childs 2004). In 2005, 35 Spikedace and an additional 27 Loach Minnow were brought in from Aravaipa Creek (Ward 2008). In 2007, 254 Aravaipa Creek Loach Minnow, 71 Blue River Loach Minnow, 143 upper Gila River Loach Minnow, 258 Aravaipa Creek Spikedace, and 640 Gila River Spikedace were brought in to the facility to increase production. More fish of most these lineages were periodically brought to the facility through 2015. Gila River forks Spikedace were first brought in to the facility in 2009, whereas Loach Minnow from the same location were first brought in in 2014. San Francisco River Loach Minnow were brought in in 2014. Table 8 shows, for Spikedace and Loach Minnow, the size of the broodstock and number of fish produced from 2007 through 2015; some information is missing.

Other fish species were brought to the facility for similar purposes to Loach Minnow and Spikedace. Woundfin were brought to the facility in 2008 to attempt to produce offspring for stocking into the Hassayampa River. Gila Topminnow (Sharp Spring lineage) and Desert Pupfish were brought in in 2009 for a competition experiment, but most were stocked out afterwards. Eagle Creek Roundtail Chub were brought to the facility in 2010 to establish a refuge population, and so that fish produced could be stocked into the Blue River. In 2012, the Cottonwood Springs lineage of Gila Topminnow was brought in to establish a broodstock so that fish produced could be used in repatriations. The facility holds various other species for research or educational purposes.

The facility was originally named Bubbling Ponds Native Fish Conservation Facility, but in 2015 was renamed the Aquatic Research and Conservation Center (ARCC). Beginning in 2014, Reclamation began providing funds (through USFWS) for a variety of improvements to ARCC, including a new outdoor building to hold more tanks, a new quarantine building and new ponds.

Results: The Department continued to operate ARCC. The ARCC continues to maintain refuge populations of three lineages of Spikedace (Aravaipa Creek, upper Gila River, Gila River Forks), four lineages of Loach Minnow (Blue River, Aravaipa Creek, San Francisco River, and Gila River Forks), one lineage of Desert Pupfish (Santa Clara Slough), one lineage of Gila Topminnow (Cottonwood Spring), and one lineage of Woundfin. Production of fish from these lineages was low during 2016: 120 Aravaipa Creek Spikedace, 426 Blue River Loach Minnow, 220 Gila River Forks Loach Minnow, 265 Aravaipa Creek Loach Minnow, 26 San Francisco River Loach Minnow, less than 50 Desert Pupfish and no Woundfin (Table 8). Staff implemented two major operation and maintenance changes this year: 1) dramatically increased the amount of nutrient-fortified frozen blood worms fed to spawning brood stocks over winter

and during spawning and 2) spawned Spikedace in circular cage tanks to accommodate construction. Spikedace did not spawn well in circular tanks (as expected; raceway spawning will resume in 2017), but Loach Minnow spawned better than many past years.

Recommendations: Department and USFWS staff recommends a meeting between ARCC managers and other researchers who have propagated Loach Minnow or Spikedace or other native fish to gain insights on how to increase production. Department staff also recommends better record keeping and reporting of the number and lineage of fish brought in, on station, produced, and stocked.

Work Planned for 2017: Plans for 2017 include maintaining the existing lineages, produce offspring to be used for repatriations, and to prophylactically treat and hold any fish salvaged from environmental perturbations (e.g., wildfire, drying, invasion of nonnative species). Staff will develop an operations manual for ARCC operations including a bloodstock management plan for Spikedace and Loach Minnow. The ARCC staff will also provide information about number of fish produced to the GRBNFCP technical committee at the annual meeting.

### **Transfer Roundtail Chub<sup>1</sup> and Gila Topminnow to New Mexico**

#### Recovery Objectives:

- Gila Chub draft recovery plan objective 2. Ensure representation, resiliency, and redundancy by expanding the size and number of populations within Gila chub historical range via replication of remnant populations within each RU.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.

Background: Gila Topminnow historically occupied the lower portion of the San Francisco River, and likely the Gila River in New Mexico, but was extirpated during the 1950's (Paroz et al 2006). Taxonomy of chub species (Gila sp.) found in the Gila River drainage has been the topic of scientific debate throughout the last 100 years, and in 2006 three forms (headwater, Roundtail and Gila) were thought to exist in New Mexico (Paroz et al. 2006), with only one location, Turkey Creek occupied by Gila Chub. Therefore, New Mexico Game and Fish Department's (NMGFD) directed conservation actions for Gila Topminnow and chub in the Gila River drainage. In 2007, NMGFD requested that the Department provide Gila Topminnow and Roundtail Chub<sup>1</sup> for repatriations in New Mexico.

Department staff transferred Gila Topminnow to New Mexico during 2007-2011. In October 2007, Department staff collected Gila Topminnow (Bylas Spring lineage) from TNC's Lower San Pedro River Preserve and transferred them to NMGFD, who stocked them into Burro Cienega, a stream east of Lordsburg, NM. A second transfer of Gila Topminnow, same donor and recipient sites, was done on June 12, 2008; 553 stocked. In July 2010, the Department

---

<sup>1</sup> Chub transferred were previously classified as Gila Chub.



collected 2,024 Gila Topminnow from TNC's Lower San Pedro River Preserve and transferred them to NMDGF who stocked them into a pond within Redrock Wildlife Area, New Mexico. In October 2011, Department staff completed a second transfer of Gila Topminnow (2,357) to Redrock Wildlife Area, NM.

Department staff collected Roundtail Chub<sup>1</sup> from Dix Creek or Harden Cienega Creek during 2010 - 2014 for translocation to Redrock Wildlife Area or Mule Creek, NM. For each translocation, the fish were first transported to ARCC, where they were prophylactically treated to remove parasites and held until NMGFD was ready to stock the fish. Department staff transferred 150 Dix Creek chub to NMDGF, who stocked them into the Redrock Wildlife Area pond in October 2010. Department staff transferred 174 additional Dix Creek chub to NMGFD who stocked them into the Redrock Wildlife Area pond in October 2011. Department staff made three transfers of chub from Harden Cienega Creek to NMDGF for stocking into Mule Creek, New Mexico: 120 in 2012, 119 in 2013, and 60 in 2014. The planned collection of chub for translocation to New Mexico in autumn 2015 was canceled because inclement weather made for unsafe conditions during the scheduled week.

Department staff collected 84 Roundtail Chub (Verde River lineage) from Bubbling Ponds Hatchery at Page Springs Arizona in February 2008, and transferred them to NMGFD who stocked them into TNC's Gila Riparian Preserve (Gila Farm) pond. Nonnative fish invaded the pond via the intake canal, which was screened in 2009. Roundtail Chub were last observed during snorkel surveys in 2009.

Results: No work was done on this project because New Mexico Department of Game and Fish (NMDGF) staff found Smallmouth Bass, Green Sunfish, and Black Bullhead in Mule Creek on February 23, 2016. Therefore, they postponed plans for additional Roundtail Chub<sup>1</sup> stockings until after the nonnative fish could be removed.

Recommendations: Once NMDGF eradicates the nonnative fish, then more chub can be stocked. Department staff will transfer more chub to NMDGF when they request more fish.

Work Planned for 2017: None because NMDGF indicated that they likely would not be able to eradicate the nonnative fish during 2016

### **Sands Draw repatriations**

#### Recovery Objectives:

- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.

---

<sup>1</sup> Chub in Dix and Harden Cienega Creek to be repatriated in New Mexico were previously classified as Gila Chub.

- Desert Pupfish recovery objective 2. Re-establish Desert Pupfish populations.
- Desert Pupfish recovery objective 5. Monitor and maintain natural, re-established, and refugium populations.
- Gila Chub draft recovery plan objective 2. Ensure representation, resiliency, and redundancy by expanding the size and number of populations within Gila chub historical range via replication of remnant populations within each RU.
- Gila Chub draft recovery plan objective 7. Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.

Background: The BLM's Sands Draw Aquatic Enhancement and Habitat Restoration Project is located in southeastern Arizona at the foot of the Peloncillo Mountains in the San Simon Valley, Graham County, Arizona. The 423-acre Sands Draw wildlife enclosure was constructed in the 1980's to exclude livestock and to manage the aquatic, semi-aquatic, and terrestrial habitat for wildlife. During 2010, BLM's Safford Field Office developed a Biological Evaluation for the translocation of Roundtail Chub<sup>1</sup>, Gila topminnow, and desert pupfish into the Sands Draw enclosure, and the FONSI and decision record was signed in 2012. BLM finished construction of the water course and filled it with water. The BLM requested that the Department hold off on stocking fish until after the stream-side vegetation was established. Another reason for postponing the fish stocking was that BLM was withdrawing water from the upper pool to water the terrestrial vegetation, and had not consulted with USFWS on effects of the water withdrawal on the endangered fish.

Results: The BLM had not yet established the stream-side vegetation in the system, so told the Department that fish could not be stocked in 2016. Therefore, no work was completed on this priority action during 2016.

Recommendations: At the December 2016 GRBNFCP Technical Committee meeting, BLM staff reported that they would not likely have the system ready for stocking fish in 2016.

Work Planned for 2017: None, because BLM has indicated it will likely not finish establishing terrestrial vegetation or consulting with USFWS in 2017.

### **Fish health assessments of translocation populations**

#### Recovery Objectives:

- Gila Chub draft recovery plan objective 1.3.1. Eliminate or control problematic nonnative aquatic organisms.

---

<sup>1</sup> Chub proposed to be repatriated were previously classified as Gila Chub.

Background: To minimize the transfer of unwanted parasites and pathogens from one location to another, the Department assesses the health of fish in all donor sites before any translocation. Department staff collects 30 to 60 fish, typically of the species to be translocated, and either the Department's Fish Health Specialist or an outside organization (e.g., USFWS Southwest Native Aquatic Resource and Recovery Center, or Washington Animal Disease Diagnostic Laboratory) assesses the fish. In 2015 the Department finished construction and outfitting its fish health laboratory at the Phoenix headquarters, so by 2016 all health assessments could be performed by the Department's Fish Health Specialist.

Results: Fish health in three donor sites was assessed during 2016. Fish were collected from proposed donor sites and transported to the Department's fish health laboratory in Phoenix for fish health assessments. On June 1, 2016 Department staff collected 56 Longfin Dace from Hidden Water Spring. No pathogens or parasites of concern were detected on these fish. On June 30, 2016, Department staff collected 60 Gila Topminnow from Walnut Spring #392 northeast of Punkin Center. No pathogens or parasites of concern were detected during the subsequent assessment. On August 24, 2016 Department staff collected 60 Gila Topminnow from Timbucktwo Tank near Amado for a fish health assessment; no parasites or pathogens of concern were detected.

Recommendations: An assessment was previously considered valid for three years, but in 2016 the Department's Fish Health Specialist indicated that an assessment is valid for only one year. Therefore, all translocation donor sites will be assessed within 12 months prior to the translocation.

Work Planned for 2017: Assessments planned for 2017 include: Nina Pulliam Rio Salado Audubon Center, Robbins Butte Wildlife Area's Swimming Pool Tank and Stop Sign Tank, The Phoenix Zoo ranarium, and Sheehy Spring in the San Rafael Valley.

### **Post-repatriation evaluations**

Results: Post-repatriation evaluations (monitoring) is reported under each specific priority action.

### **Red Tank Draw native fish restoration**

#### Recovery Objectives:

- Gila Chub draft recovery plan objective 1.3.1. Eliminate or control problematic nonnative aquatic organisms.
- Gila Chub draft recovery plan objective 7. Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.

- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Gila Topminnow recovery objective 1.214. Remove *Gambusia affinis* and/or other undesirable nonnative fishes from topminnow habitats when detrimental.

Background: Red Tank Draw is a tributary to Wet Beaver Creek and is on the Coconino National Forest. The draw is occupied by Roundtail Chub<sup>1</sup>, Longfin Dace, Desert Sucker, Sonora Sucker, and several nonnative species including Green Sunfish, Black Bullhead, Fathead Minnow, and Northern Crayfish. Roundtail Chub<sup>1</sup> inhabit an interrupted reach between the USGS gage and Mullican Canyon. Most of the rest of the drainage is dry, but perennial pools may persist in some locations. The Department's Regional staff (Matt Rinker, personal communication) walked from the confluence with Wet Beaver Creek upstream to the chub occupied portion and did not observe any waterfalls that might restrict the upstream movement of nonnative fish; but most of the distance was dry which would restrict upstream movement to periods when the stream was flowing. The purpose of this project was to remove Green Sunfish and Black Bullhead from the Roundtail Chub<sup>1</sup> occupied reach, and the entire drainage above the chub occupied reach if possible.

Results: Four nonnative fish removal efforts were performed during 2016 (Table 9). On March 21, 2016, Department staff electrofished, set mini-hoop nets, and set one gill net; the latter for <1 h). Department staff hiked from the FR645A road crossing downstream to about 300 m where the water went subsurface (NAD83, 12S 434667 3839746), and then shocked upstream to 700 m past the road crossing. Perennial water seemed to begin about 540 m upstream of the road crossing; the lower section was intermittent. During electrofishing they captured 11 Green Sunfish, 4 Black Bullhead, 14 Fathead Minnow, and 60 Northern Crayfish. In ten mini-hoop net sets they captured one Fathead Minnow. In the one gill net set they captured one Roundtail Chub<sup>1</sup>. In total they removed 11 Green Sunfish, 4 Black Bullhead, 15 Fathead Minnow, and 60 Northern Crayfish.

On July 6-7, 2016, Department staff set four small hoop nets and 10 mini collapsible hoop nets overnight at the large pool at the downstream end of perennial section (NAD83 12S 435027 3840296) and captured 3 Roundtail Chub<sup>1</sup> (181-250mm TL; 1 mortality), 79 Green Sunfish (45-160mm TL), 7 Black Bullhead (90-181mm TL), 4 Fathead Minnow (80-89mm TL), and 35 Northern Crayfish (Table 9). Many of the sunfish had ripe or nearly ripe gametes - the smallest sunfish with eggs was 62 mm TL. All nonnative species were removed. Staff also conducted a single backpack electrofishing pass from the bottom of the main pool to roughly 450 m below the first unnamed drainage on the east-side of the canyon where surface water ended (435562 3840880). They captured 56 Roundtail Chub<sup>1</sup> (25-250mm TL), 171 Green Sunfish (37-195mm

---

<sup>1</sup> Chub in Red Tank Draw were previously classified as Gila Chub.

TL), 10 Black Bullhead (166-270mm TL), and 7 Fathead Minnow (71-95mm TL). All nonnative species were removed.

On July 27-28, 2016, Department staff set 8 small hoop nets and 20 mini collapsible hoop nets overnight at several large pools that were identified in the previous survey. Pools were located at NAD83 12S 435049 3840298, 435189 3840468, 435216 3840506, 435393 3840680, and 435405 3840619. They captured 11 Roundtail Chub<sup>1</sup> (81-172mm TL), 98 Green Sunfish (177mm), 16 Black Bullhead (92-227mm TL), 1 Fathead Minnow (75mm), and 148 Northern Crayfish (Table 13). All nonnative species were removed. Green Sunfish were still producing eggs/milt. One sunfish captured (156 mm TL) was digesting a small chub (81mm TL).

Also during July 27-28, Department staff continued to investigate the presence of water within the canyon. They hiked from 450 m below the first unnamed drainage on the east-side of the canyon (435562 3840880) and up to the confluence of Rarick Canyon and Mullican Canyon (436757 3842803). Water was present throughout the majority of this section from just below the unnamed drainage (435732 384097) to about 1 km below the confluence of Rarick and Mullican Canyon (436515 3842032). Habitat types consisted primarily of shallow runs or pools and cattail marshes. There were several large pools (30 to 35m long with max depths of 1.5 m). Green Sunfish and Roundtail Chub<sup>1</sup> were visually detected all the way to the top of the wetted section. Suckers (likely Desert Suckers) were also observed in a large pool at 436267 3841761.

On August 18, 2016, Department staff backpack electrofished all water in the lower reach where removal efforts were focused on the previous three surveys. They shocked for a total of 5,214 seconds from the lowest pool to about 250 m below the first unnamed drainage on the east-side of the canyon (435722 3840982). They captured 21 Roundtail Chub<sup>1</sup> (50-167mm TL), 32 Green Sunfish (55-164 mm TL), 107 Black Bullhead (25-210 mm TL), and 2 Fathead Minnow (83-87 mm TL). All nonnative species were removed. Black Bullhead had recently spawned in one of the lower pools and several hundred YOY were observed schooling. Green Sunfish were still producing eggs.

Recommendations: Green Sunfish and chub were captured throughout the perennial reach between Mullican Canyon and FR645A. Fish may be present upstream of the Mullican and Rarick canyons confluence. Therefore the entire drainage upstream of FR645A should be surveyed for fish and perennial water.

Work Planned for 2017: Department staff plan to survey the entire drainage upstream of FR645A to document locations where fish are present. Also, they plan to survey all stock tanks in the drainage to determine if any are sources of nonnative fish.

---

<sup>1</sup> Chub in Red Tank Draw were previously classified as Gila Chub.

## **Sharp Spring native fish restoration**

### Recovery Objectives:

- Gila Topminnow recovery objective 1.214. Remove *Gambusia affinis* and/or other undesirable nonnative fishes from topminnow habitats when detrimental.
- Gila Topminnow recovery objective 4.14. Transplant topminnow into the selected sites.
- Gila Topminnow recovery objective 4.15. Monitor the transplanted populations and their habitat.
- Gila Chub draft recovery plan objective 1.3.1. Eliminate or control problematic nonnative aquatic organisms.
- Gila Chub draft recovery plan objective 2. Ensure representation, resiliency, and redundancy by expanding the size and number of populations within Gila chub historical range via replication of remnant populations within each RU.
- Gila Chub draft recovery plan objective 7. Monitor remnant, repatriated, and refuge populations to inform adaptive management strategies.

Background: Sharp Spring is a tributary to the Santa Cruz River in the San Rafael Valley, about 2 km from the U.S.A. – Mexico border, and is on San Rafael State Natural Area. Sharp Spring is perennial, and flows form a series of pools in cienga-like habitat; the larger pools have numbered posts to help detect changes over time. Sharp Springs was historically occupied by Gila Topminnow. Nonnative Western mosquitofish were introduced into Sharp Springs in 1979. Monitoring by the Department and partners documented the disappearance of Gila Topminnow, which has not been detected since 1999. The extirpation was attributed to predation and competition with nonnative mosquitofish. The purpose of this project is to eradicate Western Mosquitofish from Sharp Spring, and then repatriate Gila Topminnow and Roundtail Chub<sup>1</sup>. The Sharp Springs lineage of Gila Topminnow would be translocated from one or more of the replicate populations in the state. Roundtail Chub<sup>1</sup> from the nearby Sheehy Spring would be translocated to Sharp Spring.

During June 2013, Department staff attempted to dry the pools in Sharp Spring by pumping water out. They pumped down the two uppermost pools, but because of the large amount of fine sediment in the bottom of the pools, could not pump all of the water out. The pools partially refilled overnight, and mosquitofish were observed in them the next morning. The effort was terminated because the pools could not be completely dried. Afterwards, other ideas for eradicating the mosquitofish were proposed including: treating with rotenone, treating with ammonia, heating the water in each pool, adding organic matter to the pools to create anoxic conditions, covering the pools with black plastic or adding dye to the pools to create anoxic conditions.

---

<sup>1</sup> Chub in Sheehy Spring to be repatriated into Sharp Spring were previously classified as Gila Chub.

Results: On July 19-20, 2016, Department staff measured dimensions of all water in Sharp Spring from NAD83 12S 540814 3468792 (upstream start of trees) to 539613 3468147 (dirt road). The habitat consisted of isolated pools with a few marshy areas. No flowing water was detected, so flow measurements were not taken. To determine the volume of each pool, we measured length, width, and depth of all water (Table 10). Width of each pool was typically measured at five equally-spaced transects. Depth was recorded at five points along each transect (near each shore, at the center, and in between the pool shore and center) except in narrow pools, where depth was just measured in the center of transects.

Recommendations: Department staff thinks that the most effective way to eradicate mosquitofish from Sharp Spring would be treatment with rotenone. However, treatment with ammonia might be just as effective, but since ammonia is not a registered piscicide, numerous regulatory steps would be necessary before it could be used. The physical control methods might also be effective: heating, or shading the pools with plastic or dyes.

Work Planned for 2017: The Department's Program staff will coordinate the with the Department's Region V office and State Parks to select the method of control and then to begin planning for implementation.

### **2017 WORK PLAN SCHEDULE**

Planned week that field work will be performed for each priority action during 2017; ordered chronologically.

<u>Priority Action</u>	<u>Description of work</u>	<u>Planned Week</u>
Gila Topminnow Stocking	Copper Creek (Agua Fria drainage) Habitat Assessment #3	20-Feb
Fish Health Assessment	Robbins Butte Stop Sign and Swimming Pool Tanks POOC Collection for Health	20-Mar
Fish Health Assessment	Rio Salado Audubon Center POOC and CYMA Collection for Health	20-Mar
West Fork Pinto Native Fish Repatriations	West Fork Pinto Creek Habitat Assessment and Fish Survey	27-Mar
Assess Potential Repatriation Waters	Haunted Canyon Habitat Assessment and Fish Survey	27-Mar
Red Tank Draw Removals	Red Tank Draw LECY Removal #1	3-Apr
Red Tank Draw Removals	Red Tank Draw LECY Removal #2 and Recon	10-Apr
Assess Potential Repatriation Waters	Fish Creek Habitat Assessment	10-Apr
Red Tank Draw Removals	Red Tank Draw LECY Removal #3 and Recon	19-Apr
Transfer Roundtail Chub and Gila Topminnow to New Mexico	Harden Cienega Chub Monitoring above Waterfall	24-Apr
Red Tank Draw Removals	Red Tank Draw LECY Removal #4 and Recon	1-May
Gila Topminnow Stocking	Rock Creek AGCH Monitoring	8-May
Red Tank Draw Removals	Red Tank Draw Stock Tanks Survey	8-May
Arnett Creek Native Fish Repatriations	Arnett Creek & Telegraph Canyon POOC Stocking	15-May
Gila Topminnow Stocking	Charlebois Spring POOC stocking	15-May

<b><u>Priority Action</u></b>	<b><u>Description of work</u></b>	<b><u>Planned Week</u></b>
Gila Topminnow Stocking	Copper Creek POC Stocking	22-May
Gila Topminnow Stocking	Haunted Canyon POOC Stocking	22-May
Gila Topminnow Stocking	Indian and Sycamore Creeks POOC stocking	22-May
West Fork Pinto Native Fish Repatriations	West Fork Pinto Creek POOC & maybe GIRO Stocking	22-May
Muleshoe Repatriations	Green Sunfish Removal	29-May
Fresno Canyon Repatriations	Monitor Chub in Sheehy Spring and Coordinate with Rancher	5-Jun
Red Tank Draw Removals	Red Tank Draw Stocks Tank Survey	5-Jun
Fish Health Assessment	Sheehy Spring GAAF collection for Fish Health	5-Jun
Gila Topminnow Stocking	Tortilla Creek POOC stocking	8-Jun
Muleshoe Repatriations	Hot Springs Canyon Wet-Dry Mapping	12-Jun
Muleshoe Repatriations	Double R Canyon Assessment	12-Jun
Gila Topminnow Stocking	Sabino Canyon Annual Monitoring	12-Jun
Red Tank Draw Removals	Red Tank Draw Stock Tanks Survey	19-Jun
Blue River Repatriations	Catfish and Sunfish Removal	26-Jun
Assess Potential Repatriation Waters	Buehman Canyon Habitat Assessment	3-Jul
Assess Potential Repatriation Waters	Cave Creek (Chiricahua Mnts) Habitat Assessment	10-Jul
Red Tank Draw Removals	Red Tank Draw LECY Removal #5	14-Jul
Assess Potential Repatriation Waters	Pigeon, Thomas-Squaw, Little Blue Creeks Habitat and Fish Assessments	17-Jul
Fresno Canyon Repatriations	Translocation of Roundtail Chub <sup>1</sup> from Sheehy Spring to Fresno Canyon	24-Jul
Assess Potential Repatriation Waters	Calf Pen & Hardscrabble Creeks Fish and Habitat Survey	28-Jul
Gila Topminnow Stocking	Hidden Water Spring Monitoring	31-Jul
Gila Topminnow Stocking	Rock Spring Annual Monitoring	31-Jul
Gila Topminnow Stocking	BLM Las Cienegas/San Pedro Riparian NCA Annual Monitoring	7-Aug
Gila Topminnow Stocking	BLM Las Cienegas/San Pedro Augmentations	21-Aug
Gila Topminnow Stocking	Sheepshead Canyon Monitoring	4-Sep
Spring Creek (Oak) Native Fish Restoration	Spring Creek (Oak) Annual Monitoring	4-Sep
Acquire Spikedace and Loach Minnow	Blue River TICO Collections	11-Sep
Blue River Repatriations	Middle Blue River GIRO Monitoring and Loach Minnow Collection	11-Sep
Muleshoe Repatriations	Annual Monitoring	18-Sep
Bonita Creek Repatriations	Annual Monitoring	25-Sep
Blue River Repatriations	Lower Blue River Annual Monitoring	2-Oct
Muleshoe Repatriations	Bass Canyon TICO Stocking & Double R Canyon POOC stocking	9-Oct
Bonita Creek Repatriations	TICO and POOC stockings	9-Oct
Acquire Spikedace and Loach Minnow	Upper Eagle Creek eDNA Surveys	16-Oct
Gila Topminnow Stocking	Copper Creek 6-Month Post-Stocking Monitoring	16-Oct
Sharp Spring Native Fish Restoration	Potential Week for GAAF Eradication	16-Oct

<sup>1</sup> Chub in Sheehy Spring were previously classified as Gila Chub.



<u>Priority Action</u>	<u>Description of work</u>	<u>Planned Week</u>
Gila Topminnow Stocking	Tortilla Creek 6-Month Post-Stocking Monitoring	23-Oct
Gila Topminnow Stocking	Haunted Canyon 6-Month Post-Stocking Monitoring	23-Oct
Gila Topminnow Stocking	Charlebois Spring 6-Month Post-Stocking Monitoring	23-Oct
Spring Creek (Oak) Native Fish Restoration	Spring Creek (Oak) MEDA and POOC Augmentations	23-Oct
West Fork Pinto Native Fish Repatriations	West Fork Pinto Creek 6-Month Post-Stocking Monitoring	23-Oct
Gila Topminnow Stocking	Sabino Canyon POOC Augmentation	30-Oct
Assess Potential Repatriation Waters	Deadman Creek Habitat Assessment	30-Oct
Acquire Spikedace and Loach Minnow	Aravaipa TICO and MEFU Collections	6-Nov
Arnett Creek Native Fish Repatriations	Arnett Creek 6-Month Post-Stocking Survey	8-Nov
Gila Topminnow Stocking	Indian and Sycamore Creeks 6-Month Post-stocking Monitoring	20-Nov

## LITERATURE CITED

Bagley, B. 2002. Survey of Verde River drainage, Arizona for loach minnow (*Tiaroga cobitis*). Final report to US Fish and Wildlife Service, Phoenix, AZ, 48pp + maps.

Burger, B. 2014. South Fork Sheep Creek and Tournament Creek fish & riparian herpetofauna survey trip report. Arizona Game and Fish Department, Region VI Office, Mesa, Arizona.

Childs, M. R. 2004. Development of propagation techniques for loach minnow. Final Report to U. S. Bureau of Reclamation, Phoenix Area Office, Cooperative Agreement No. 02-FC-32-0100. Arizona Game and Fish Department, Phoenix.

Crowder, C.D. and A.T. Robinson. 2011. Devils Canyon Drainage Stock Tank Surveys During 2010 and 2011. Arizona Game and Fish Department, Phoenix.

Crowder, C.D., A.T. Robinson and D.B. Pearson. 2013. Blue River drainage stock tank surveys during 2012 and 2013. 2013 Final Report. Annual Report to Gila River Basin Native Fishes Conservation Program, Task 4-51 of U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Crowder, C.D., T.S. Love-Chezem, and A.S. Makinster. 2014. Mineral Creek Drainage Fish Surveys During 2013. 2013 Report. Report to Gila River Basin Native Fishes Conservation Program, Tasks 4-51 and 3-78a of U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Wildlife Branch, Phoenix.

Ehret, S., and B. Dickens. 2009a. Sabino Canyon survey trip report, June 3-4, 2009. Arizona Game and Fish Department, Region V, Tucson.

Ehret, S., and B. Dickens. 2009b. Stock Pond Survey Report, May-July, 2009. Arizona Game and Fish Department, Region V, Tucson.

Ehret, S., and G. Frederick. 2008. Stock Tank Surveys within the O'Donnell and Turkey Creek Watersheds. Arizona Game and Fish Department, Region V, Tucson.

Frear, L. R., R. R. Staffeldt, A. T. Robinson, and C. D. Crowder. 2015. Attempted establishment of Gila Topminnow in Rock Spring, Arizona. Annual Report to Gila River Basin Native Fishes Conservation Program, Under Task 3-75a; U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Love-Chezem, T. S., A. T. Robinson, and C. D. Crowder. 2015a. Muleshoe Cooperative Management Area native fish restoration: 2014 activities. A Gila River Basin Native Fishes Conservation Program Progress Report for Task 3-75f; U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Wildlife Branch, Phoenix.

Love-Chezem, S. T., A. T. Robinson, and C. D. Crowder. 2015b. Attempted establishment of Gila Topminnow and Desert Pupfish within Las Cienegas and San Pedro Riparian National Conservation Areas: Progress thru 2014. Progress Report to Gila River Basin Native Fishes Conservation Program, Under Task 3-75a; U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Wildlife Branch, Phoenix.

Minckley, W.L. and DeMarais, B.D. 2000. Taxonomy of Chubs (Teleostei, Cyprinidae, Genus Gila) in the American Southwest with Comments on Conservation. *Copeia* 2000:251-256.

Mosher, K. R., T. S. Love-Chezem, and A. T. Robinson. 2016. Gila topminnow and desert pupfish stocking activities during 2015. Progress Report to Gila River Basin Native Fishes Conservation Program, Under Task 3-75a; U.S. Fish and Wildlife Service Cooperative Agreement No. F14AC00148. Arizona Game and Fish Department, Nongame Wildlife Branch, Phoenix.

Paroz, Y. M., D. L. Propst, and J. A. Stefferud. 2006. Long-term monitoring of fish assemblages in the Gila River drainage, New Mexico. Report by New Mexico Game and Fish Department submitted to U. S. Fish and Wildlife Service, Arizona Ecological Services Office, Phoenix, and U. S. Bureau of Reclamation, Phoenix.

Pearson, D. B., A. T. Robinson, and C. D. Crowder. 2013. Establishment of Gila Topminnow and Desert Pupfish at Robbins Butte Wildlife Area. Final Report to Gila River Basin Native Fishes Conservation Program, Under Task 3-75a of U.S. Fish and Wildlife Service Cooperative Agreement No. 201816J808. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Robinson, A. T. 2009. Gila River Basin Native Fishes Conservation Program: Cooperative Agreement 201816J808 Quarterly Report for the period April 1, 2009-June 30, 2009. Submitted to U.S. Fish and Wildlife Service, Ecological Services, Tucson, AZ. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Robinson, A. T., C. Crowder, and D. Boyarski. 2010. Mechanical removal of nonnative fishes from the Blue River during June 1-3, 2009. Nongame Branch, Arizona Game and Fish Department, Phoenix, AZ.

Robinson, A. T., C. D. Crowder, and D. B. Pearson. 2013. Blue River Native Fish Restoration Project: 2012 Annual Report. Annual Report to Gila River Basin Native Fishes Conservation Program, Task 3-42 of U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Robinson, A. T., C. D. Crowder, and D. B. Pearson. 2014. Blue River Native Fish Restoration Project: 2013 Annual Report. Annual Report to Gila River Basin Native Fishes Conservation Program, Task 3-42 of U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Robinson, A., and T. Love-Chezem. 2015. Blue River Native Fish Restoration Project: 2014 Annual Report. Annual Report to Gila River Basin Native Fishes Conservation Program, for Task 3-42 of U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Robinson, A., and T. Love-Chezem. 2016. Blue River Native Fish Restoration Project: Report of 2015 Activities. Annual Report to Gila River Basin Native Fishes Conservation Program, for Task 3-42 of U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084. Arizona Game and Fish Department, Nongame Branch, Phoenix.

Timmons, R. J. and S. A. Paulus. 2016. Fish monitoring in selected streams within the Gila River Basin, 2015. Annual report in partial fulfillment of: Bureau of Reclamation Contract No. R12PC32007. Arizona Game and Fish Department, Aquatic Wildlife Branch, Phoenix, AZ. 40 pp. + appendices.

U.S. Fish and Wildlife Service. 1983. Gila and Yaqui Topminnow Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 56 pp.

U.S. Fish and Wildlife Service. 1990. Spikedace Recovery Plan. Albuquerque, New Mexico. 38 pp.

U.S. Fish and Wildlife Service. 1990. Loach Minnow Recovery Plan. Albuquerque, New Mexico. 38 pp.

U.S. Fish and Wildlife Service. 2002. Razorback sucker (*Xyrauchen texanus*) Recovery Goals: amendment and supplement to the Razorback Sucker Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2015. Gila chub (*Gila intermedia*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico. 118 pp. + Appendices A-C.

Ward, D. L. 2008. Bubbling Ponds Native Fish Propagation and Research Facility Status Update - February 2008. Report to U.S. Bureau of Reclamation, Phoenix Area Office, by Arizona Game and Fish Department, Research Branch, Phoenix.

**TABLES**

Table 1. Summary of fish captured during single-pass backpack electrofishing surveys of nine 100-m transects in Hot Springs Canyon and seven 100-m transects in Redfield Canyon Arizona during September 19-20, 2016. N is the number of transects per reach, and #Ind/h = mean number of fish captured per hour.

Stream	Reach	N	Statistic	Species									
				Spikedace	Loach Minnow	Speckled Dace	Longfin Dace	Roundtail Chub <sup>3</sup>	Desert Sucker	Sonora Sucker	Gila Topminnow	Green Sunfish	Total
Hot Springs	1	3	#Ind		47	233	57	20	87	12			456
			#Ind/h	0.00	81.69	403.13	98.42	34.69	150.46	20.71		789.10	
			SE	(.00)	(46.59)	(86.46)	(26.63)	(20.39)	(86.34)	(13.25)		(278.71)	
	2	3	#Ind	1	23	182	98	23	63	1			391
			#Ind/h	4.38	97.87	540.47	301.46	50.32	232.38	1.71		1228.59	
			SE	(4.38)	(95.60)	(315.09)	(190.88)	(10.31)	(192.97)	(1.71)		(805.05)	
	3	3	#Ind			6	42	19	1				68
			#Ind/h	0.00	0.00	12.97	78.92	38.02	2.16	0.00		132.07	
			SE	(.00)	(.00)	(12.97)	(14.60)	(19.24)	(2.16)	(.00)		(41.99)	
Total	9	#Ind	1	70	421	197	62	151	13			915	
		#Ind/h	1.46	59.85	318.86	159.60	41.01	128.33	7.47		716.59		
		SE	(1.46)	(34.23)	(123.09)	(66.17)	(8.94)	(69.71)	(5.09)		(293.27)		
Redfield	1	5	#Ind			1		64		46	0	1	112

<sup>3</sup> Chub in Hot Springs and Redfield canyons were previously classified as Gila Chub.

		#Ind/h	.87	59.18	41.01	0.00	.86	101.91
		SE	(.87)	(5.68)	(15.13)	(.00)	(.86)	(17.05)
2	2	#Ind	0	0	0	1	1	2
		#Ind/h	0.00	0.00	0.00	2.63	2.63	5.26
		SE	(.00)	(.00)	(.00)	(2.63)	(2.63)	(5.26)
Total	7	#Ind	1	64	46	1	2	114
		#Ind/h	.62	42.27	29.29	.75	1.36	74.30
		SE	(.62)	(11.60)	(12.90)	(.75)	(.89)	(21.39)

---

Table 2. Number of fish captured and catch per unit effort of fishes during the Green Sunfish removal in Redfield Canyon, Arizona, near the downstream wilderness boundary on September 21, 2016.

Gear	N	Statistic	Species		
			Sonora Sucker	Gila Topminnow	Green Sunfish
Minnow trap	2	#Ind	0	5	8
		#Ind/h		1.05	1.77
		SE		1.05	.32
Hoop Net	16	#Ind	2	0	119
		#Ind/h	.05		3.58
		SE	.05		.76
Total	18	#Ind	2	5	127
		#Ind/h	.05	.12	3.38
		SE	.05	.12	.69

Table 3. Number of fish captured in minnow traps and catch per unit effort in Bass Canyon (two locations), Wildcat Canyon, and Mint Spring on September 19, 2016 at Muleshoe Ranch CMA, Arizona.

Water	N	Statistic	Species			
			Speckled Dace	Roundtail Chub <sup>4</sup>	Gila Topminnow	Leopard frog
Bass Canyon, lower	10	#Ind	6	85	0	0
		Mean	0.18	2.42		
		SE	0.08	0.92		
Bass Canyon, upper	10	#Ind	1	32	70	0
		Mean	0.03	0.88	2.10	
		Se	0.03	0.29	0.93	
Mint	10	#Ind	0	0	0	0
Wildcat	11	#Ind	0	0	448	1
		Mean			11.98	0.04
		SE			3.58	0.04

<sup>4</sup> Chub in Bass Canyon were previously classified as Gila Chub.

Table 4. Number and catch per unit effort (#/h) of fish captured by backpack electrofishing in three transects surveyed for Loach Minnow, and in minnow traps near stocking locations for Gila Topminnow and Desert Pupfish in upper Bonita Creek, Arizona during September 29, 2016. For electrofishing, 396, 508, 754 seconds were shocked in transects 11, 13, and 5 respectively.

Gear	Subreach	N	Statistic	Species								
				Longfin Dace	Speckled Dace	Roundtail Chub <sup>5</sup>	Desert Sucker	Sonora Sucker	Gila Topminnow	Fathead Minnow	Total	American Bullfrog
BP Electrofisher	Transect 11-random	1	# Ind	0	26	12	7	3	1	0	49	1
			#Ind/h		236.36	109.09	63.64	27.27	9.09		445.45	9.09
	Transect 13-fixed	1	# Ind	22	118	17	26	12	24	1	220	1
			#Ind/h	155.91	836.22	120.47	184.25	85.04	170.08	7.09	1559.06	7.09
	Transect 5-random	1	# Ind	0	25	22	30	46	0	1	124	3
			#Ind/h		119.36	105.04	143.24	219.63		4.77	592.04	14.32
	Total	3	# Ind	156	981	248	357	351	170	13	393	4
			Mean #Ind/h	51.97	397.32	111.53	130.37	110.65	59.72	3.95	519.69	7.14
			SE	51.97	222.04	4.62	35.41	56.99	55.24	2.09	519.69	4.13
Minnow trap	Res Boundary-Pupfish	10	Valid N	0	0	25	0	0	0	0	25	0
			Mean #Ind/h			1.06					1.06	
			SE			.27					.27	
	Res Boundary-topminnow	12	Valid N	0	0	223	0	4	31	3	261	1
			Mean #Ind/h			8.37		.15	1.12	.11	9.75	.04
			SE			2.34		.11	.59	.06	2.18	.04
	Midnight-topminnow	6	Valid N	0	3	1	0	0	55	0	59	0
			Mean #Ind/h		.14	.05			2.50		2.68	
			SE		.14	.05			2.45		2.63	

<sup>5</sup> Chub in Bonita Creek were previously classified as Gila Chub.



Table 5. Number of fish of each species captured by backpack electrofishing and mean catch rates (# individuals/h) in three 100-m transects and in minnow traps set outside of those transects in Spring Creek, tributary of Oak Creek, Coconino County, Arizona, on September 12, 2016. Not reported in the table is that one Spikedace was captured outside of these transects.

Gear	Transect	N	Statistic	Species					
				Longfin Dace	Speckled Dace	Roundtail Chub <sup>6</sup>	Desert Sucker	Gila Topminnow	Northern Crayfish
Backpack electrofisher	Random 1-1	1	#Ind	0	12	12	3		
			#Ind/h		56.7	56.7	14.2		
	Random 2-1	1	#Ind	0	7	22	7		
			#Ind/h		75.1	97.2	30.9		
	Fixed 2-1	1	#Ind	6	34	39	6		
			#Ind/h	21.4	121.5	139.4	21.4		
	Total	3	#Ind	6	53	73	16		
			Mean Ind/h	7.1	84.4	97.8	22.2		
			SE	12.36	33.39	41.35	8.38		
Minnow trap	16	#Ind	5	30	136	1	1	174	
		Mean Ind/h	0.13	0.66	2.8	0.02	0.03	3.62	
		SE	0.13	0.17	1.04	0.02	0.03	0.66	

<sup>6</sup> Chub in Spring Creek were previously classified as Gila Chub.

Table 6. Summary of fish captured in hoop nets in the lower Blue River, Arizona, during the October 2016 annual monitoring.

Reach	# nets	Statistic	Roundtail Chub	Sonora Sucker	Crayfish	Total fish
2	3	# Ind.	0	7	14	7
		Mean #Ind/h		1.90	3.80	1.90
		SE		(1.18)	(1.96)	(1.18)
3	7	# Ind.	24	18	46	42
		Mean #Ind/h	2.20	1.65	4.37	3.86
		SE	(.75)	(.83)	(1.37)	(1.25)
4	5	# Ind.	17	15	145	32
		Mean #Ind/h	2.08	1.84	17.71	3.91
		SE	(.91)	(.39)	(5.68)	(1.19)
5	5	# Ind.	11	3	26	14
		Mean #Ind/h	1.28	.37	3.06	1.65
		SE	(.38)	(.25)	(1.00)	(.44)
6	4	# Ind.	0	12	5	12
		Mean #Ind/h		2.16	.81	2.16
		SE		(1.94)	(.81)	(1.94)
Total	24	# Ind.	52	55	236	107
		Mean #Ind/h	1.34	1.54	6.21	2.88
		SE	(.34)	(.42)	(1.73)	(.56)

Table 7. Summary of fish captured by backpack electrofishing in the lower Blue River, Arizona during October 2016 annual monitoring.

Reach	# Transects	Statistic	Spikedace	Loach Minnow	Speckled Dace	Longfin Dace	Roundtail Chub	Sonora Sucker	Fathead Minnow	Total fish
2	2	# Ind.	42	1	19	18	11	45	0	136
		Mean #Ind/h	86.62	2.14	39.45	32.66	21.04	91.36		273.28
		SE	(59.09)	(2.14)	(29.12)	(15.52)	(.39)	(50.06)		(125.29)
3	2	# Ind.	68	2	49	105	2	51	0	277
		Mean #Ind/h	109.87	3.41	77.83	167.41	3.06	84.34		445.92
		SE	(2.63)	(3.41)	(23.28)	(37.87)	(3.06)	(38.38)		(19.78)
4	2	# Ind.	47	1	20	28	6	22	0	124
		Mean #Ind/h	81.85	1.56	36.33	47.42	10.04	37.73		214.94
		SE	(13.28)	(1.56)	(20.75)	(5.56)	(2.43)	(.33)		(24.81)
5	3	# Ind.	74	11	59	148	8	109	0	409
		Mean #Ind/h	58.56	8.47	48.68	138.72	6.54	89.40		350.38
		SE	(18.00)	(2.52)	(15.26)	(53.10)	(2.33)	(26.28)		(34.84)
6	3	# Ind.	38	4	123	132	3	94	1	395
		Mean #Ind/h	36.67	3.65	111.52	129.99	2.59	90.96	1.05	376.44
		SE	(10.19)	(.65)	(24.64)	(61.57)	(1.43)	(28.86)	(1.05)	(93.38)
Total	12	# Ind.	269	19	270	431	30	321	1	1341
		Mean #Ind/h	70.20	4.21	65.65	108.43	7.97	80.66	.26	337.39
		SE	(11.56)	(1.09)	(12.07)	(23.53)	(2.07)	(12.79)	(.26)	(34.80)

Table 8. Summary of number of broodstock (#B), number of offspring produced (#P), number of offspring stocked (#S) for each species and lineage held at the Aquatic Research and Conservation Center, from 2007 through 2016. Numbers stocked do not include fish transferred to New Mexico.

Taxa	Extant Lineage/Stream		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Spikedace	upper Gila River, NM	#B	640	XX	XX	XX	XX	XX		380	392	531	
		#P		(740)	(165)	(2555)	(539)	(1300)		(1000)	(296)		
		#S		448	165	545		539			296		
	Gila River Forks	#B			17	267	XX	XX	XX	250	204	138	
		#P	NA	NA	(0)	(379)	(0)	(800)	(700)	(300)		(0)	
		#S											
	Aravaipa Creek	#B	258	XX	XX	XX	XX	XX		480	412	262	
		#P	(100)	(1650)	(410)	(5993)	(4663)	(3471)		(221)	(35)	(120)	
		#S	125	1600	386	2954	4663	3471			221	67	
Loach Minnow	upper Gila River, NM	#B	143							NA	NA	NA	
		#P											
		#S											
	Gila River Forks	#B								57	81	96	
		#P	NA	NA	(0)	(0)	(0)			(250)		(220)	
		#S											
	San Francisco R., NM	#B								27	119	215	
		#P	NA	NA	NA					(500)		(26)	
		#S											
	Blue River & tribs	#B	71	XX	XX	XX	150			XX	180	245	214
		#P		(670)	(22)	(164)	(722)			(1500)	(288)		(426)
		#S		678		156		217	310	288		390	
Aravaipa Creek	#B	254	XX	XX	XX	XX			XX	340	316	297	
	#P	(1004)	(3250)	(274)	(1623)	(1035)			(951)	(0)		(265)	
	#S	124	4003	156	1561	527		951					
Roundtail chub	Eagle Creek	#B					XX			85	85	101	
		#P					(149)			(1500)	(2000)	(0)	
		#S						221			876	1194	

Table 9. Summary of fish captured during the four nonnative fish removal efforts from Red Tank Draw, Arizona during 2016. N is the number of net sets or electrofishing efforts. Catch per unit effort (#Individuals/h) for backpack electrofishing in March was based on four efforts because seconds was not recorded for one effort.

Date	Gear	N	Statistic	Roundtail Chub <sup>7</sup>	Green Sunfish	Black Bullhead	Fathead Minnow	Northern Crayfish	
21-Mar	Mini Hoop	10	#Ind	0	0	0	1	0	
			#Ind/h				0.58		
	BP Electrofisher	5	#Ind	1	11	4	14	60	
			#Ind/h	1.24	16.96	0.00	6.42	65.56	
	Gill net	1	#Ind	1	0	0	0	0	
			#Ind/h						
7-Jul	Hoop Net	4	#Ind	0	57	0	3	7	
			#Ind/h		0.95		0.05	0.12	
	Mini Hoop	10	#Ind	3	22	7	1	28	
			#Ind/h	0.02	0.15	0.05	0.01	0.16	
	BP Electrofisher	1	#Ind	56	171	10	7	0	
			#Ind/h	60.41	184.48	10.79	7.55		
	28-Jul	Hoop Net	8	#Ind	2	48	0	0	41
				#Ind/h	0.01	0.035			0.03
		Mini Hoop	20	#Ind	9	50	16	1	107
				#Ind/h	0.03	0.15	0.05	0.003	0.31
		BP Electrofisher	1	#Ind	21	32	107	2	
				#Ind/h	14.5	22.09	73.88	1.38	
Total				93	391	144	29	243	

<sup>7</sup> Chub in Red Tank Draw were previously classified as Gila Chub.

Table 10. Summary of habitat dimensions measured on July 19-20, 2016 at Sharp Spring, Santa Cruz County, Arizona. Coordinates are for Datum NAD83, zone 12R.

Habitat	Easting	Northing	Length (m)	Width (m)	Depth (m)	Volume (m <sup>3</sup> )	Notes
Pool 1	540522	3468775	16.93	2.76	0.60	28.20	
Channel 1	540513	3468791	5.11	1.75	0.77	6.86	
Pool 2	540511	3468794	30.65	4.15	0.93	118.05	Gauge #2
Pool 3	540420	3468791	11.27	4.79	1.10	59.60	Vegetation mat covers 20% of surface
Marsh@P3	540420	3468791	2.62	2.10	-	5.50*	Marshy grass area at bottom of Pool 3
Pool 4	540367	3468796	15.83	6.32	1.46	145.92	
Marsh@P4	540367	3468796	0.80	0.70	-	0.56*	Marshy area at bottom of Pool 4
Pool 5A	540347	3468782	8.63	1.79	0.31	4.73	
Pool 5B	540334	3468766	3.50	1.37	0.11	0.55	Depth measured along length
Pool 5C	540323	3468767	4.84	2.58	0.47	2.63	Gauge #5
Pool 6A	540287	3468786	4.55	1.22	0.52	2.88	No duckweed; Depth measured along length
Pool 6B	540280	3468793	4.61	1.86	0.94	2.47	Depth measured along length
Pool 7A	540263	3468795	5.64	1.26	0.48	2.46	Depth measured along length
Pool 7B	540256	3468796	33.87	3.70	1.27	159.52	
Pool 7C	540217	3468780	6.95	1.72	0.67	7.95	
Marsh@Channel 2	540217	3468780	38.00	0.06	-	2.28*	Marshy channel - no surface water, but soil saturated.
Pool 8A	540186	3468761	11.12	1.63	0.90	16.28	
Pool 8B	540166	3468746	25.00	2.61	0.94	61.57	
Pool 9	540121	3468705	28.50	4.93	0.43	60.45	Gauge #0
Pool 10	539724	3468405	36.50	3.30	0.37	43.96	East of road crossing

## **FIGURES**

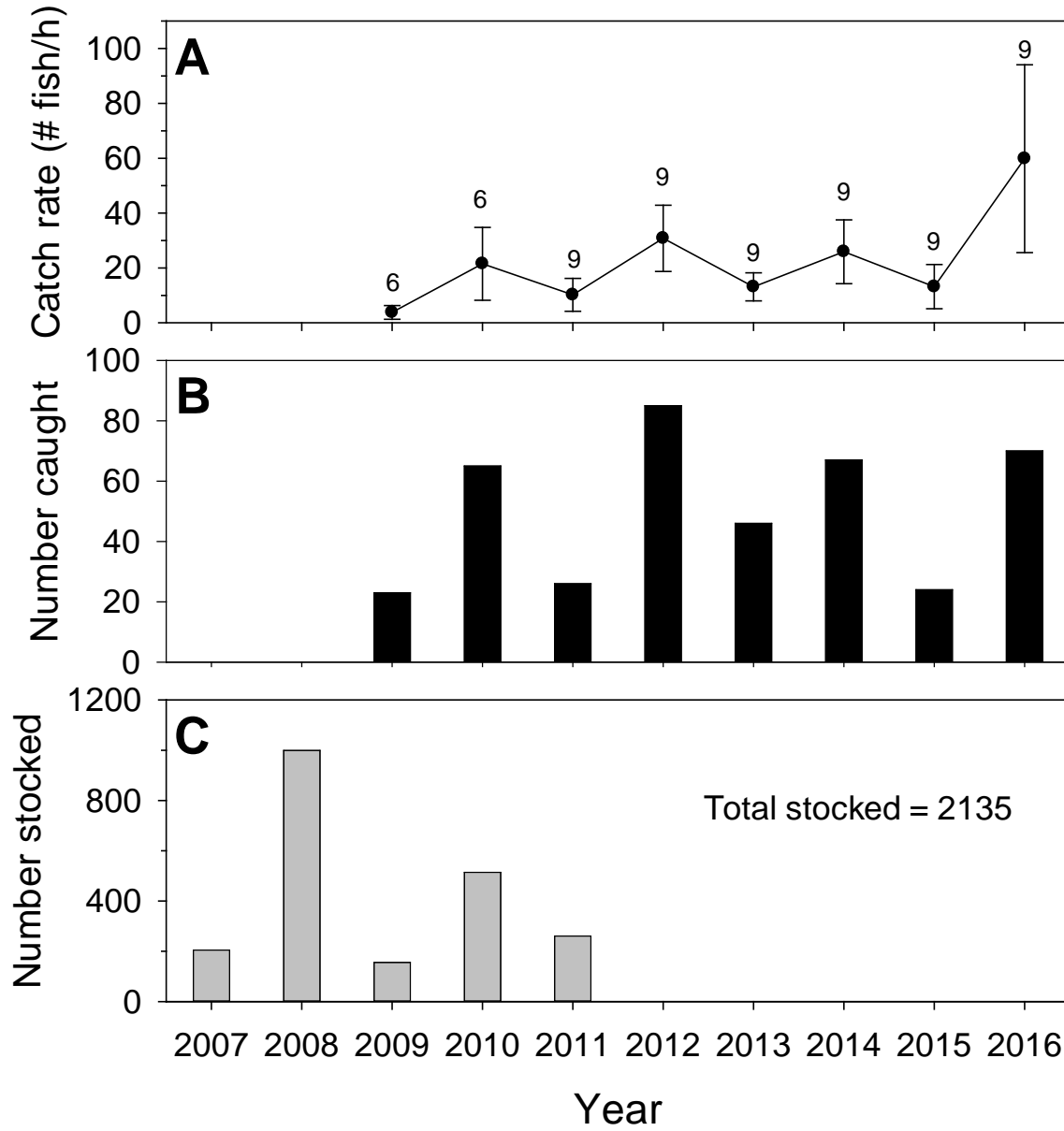


Figure 1. Summary of Loach Minnow stocked and captured in Hot Springs Canyon, AZ, 2007 thru 2016, showing (A) backpack electrofishing catch rates with the number above the error bar representing the sample size which equaled the number of 100-m transects surveyed, (B) total number captured, and (C) total number stocked.



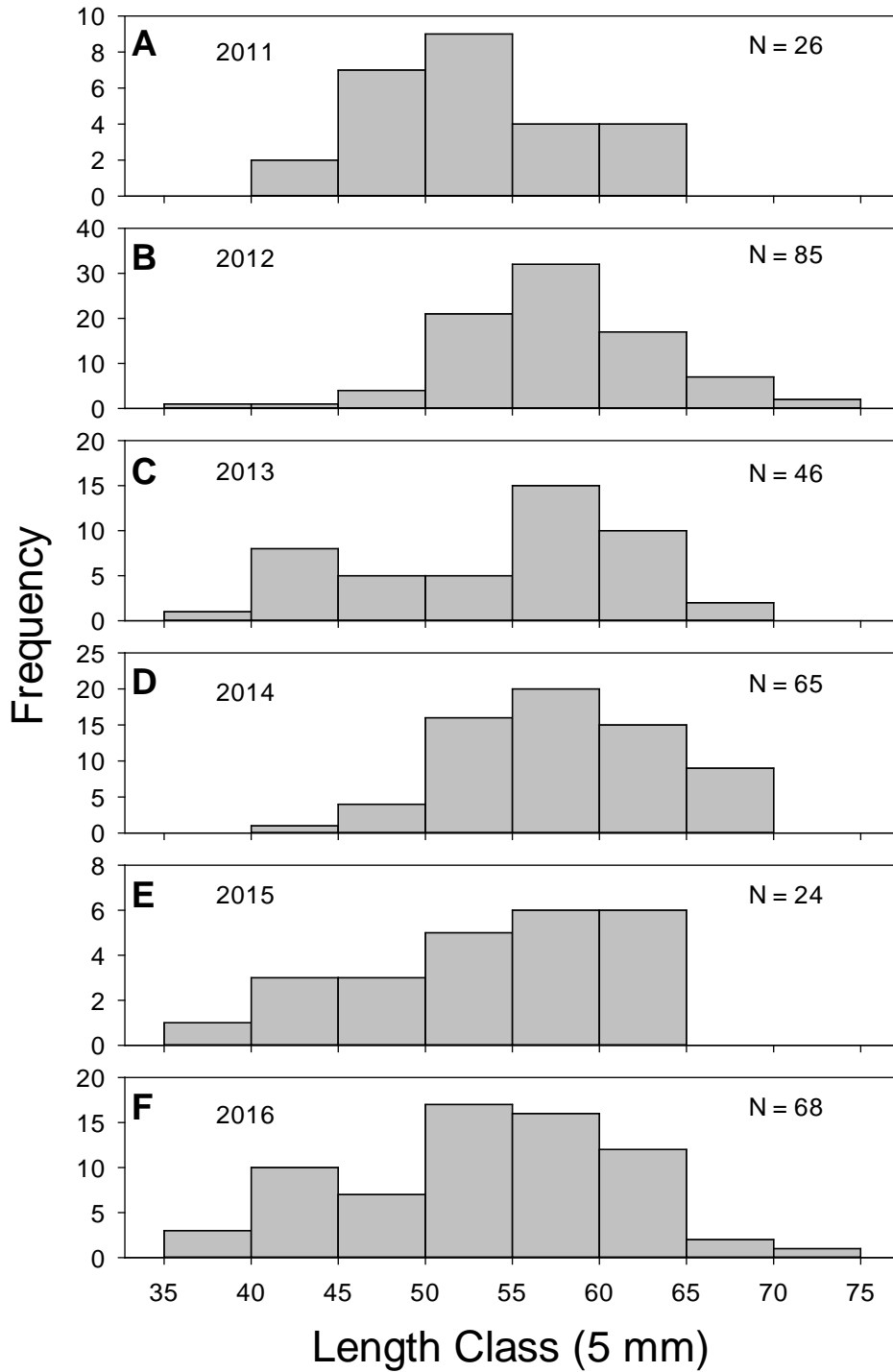


Figure 2. Length frequency distributions in 5-mm classes for Loach Minnow captured during annual monitoring in Hot Springs Canyon, 2011 through 2016.

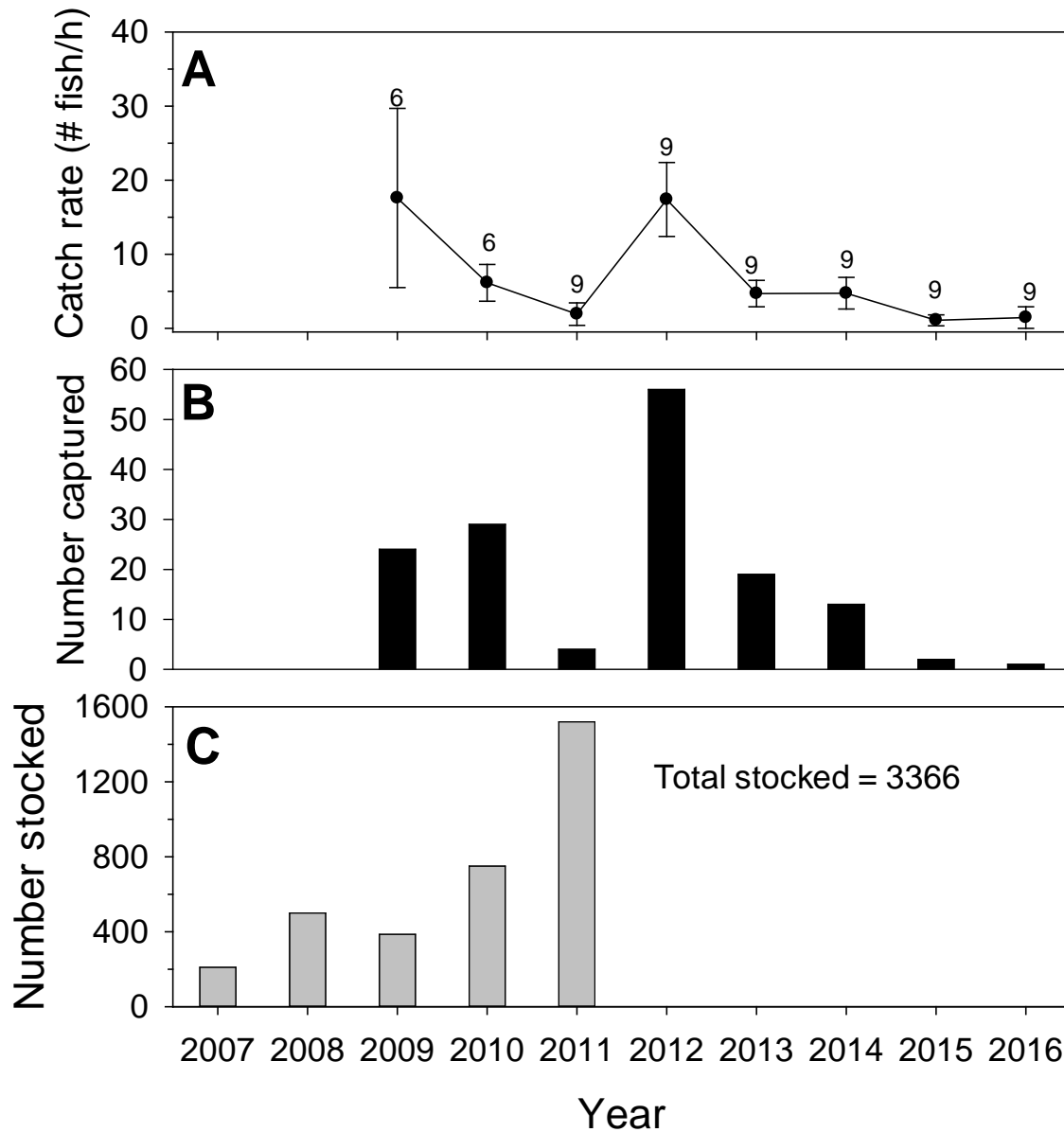


Figure 3. Spikedace stocked and captured in Hot Springs Canyon, Arizona, 2007 thru 2016, showing (A) backpack electrofishing catch rates with the number above the error bar representing the sample size which equaled the number of 100-m transects surveyed, (B) total number captured, and (C) total number stocked.

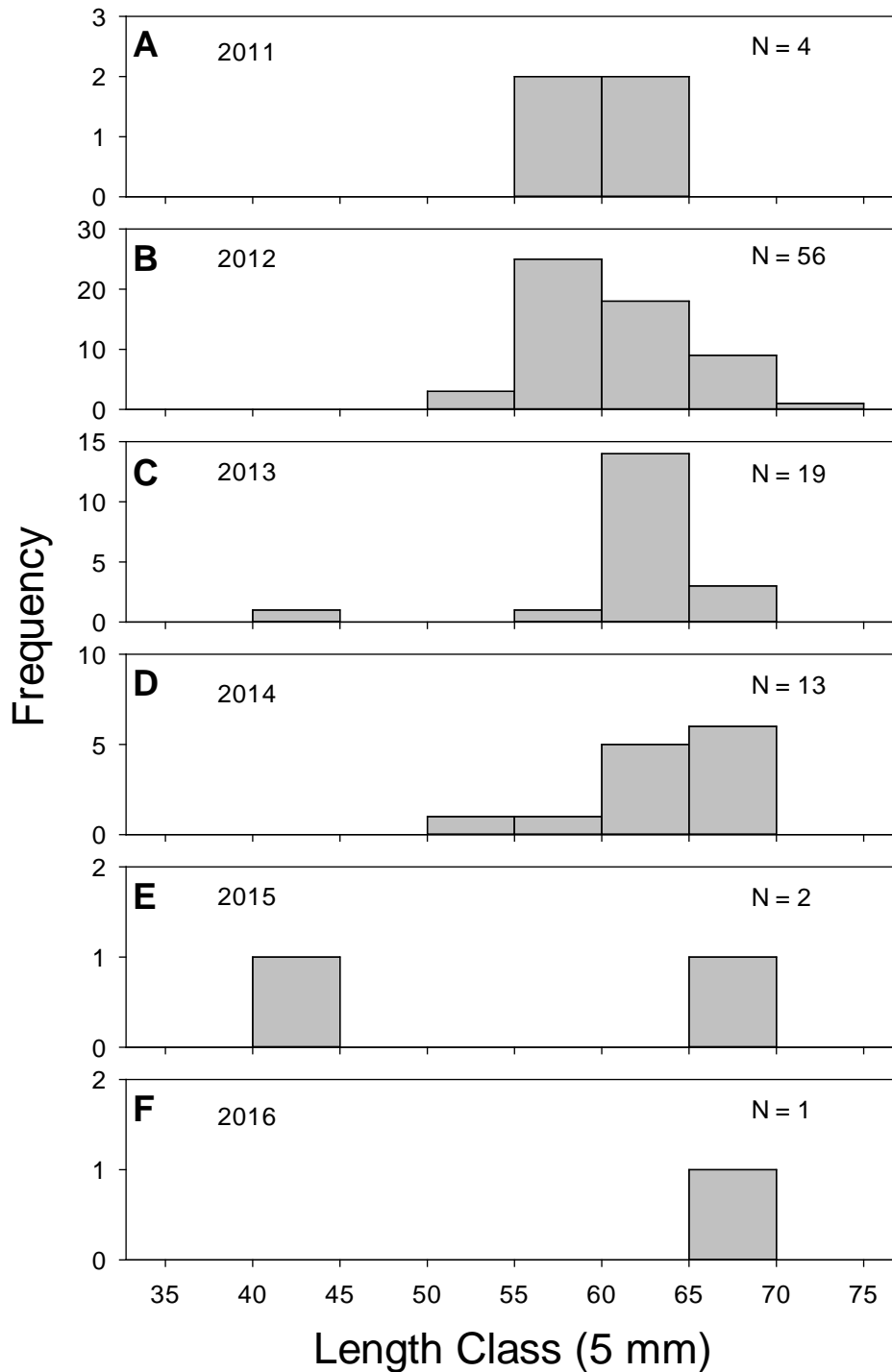
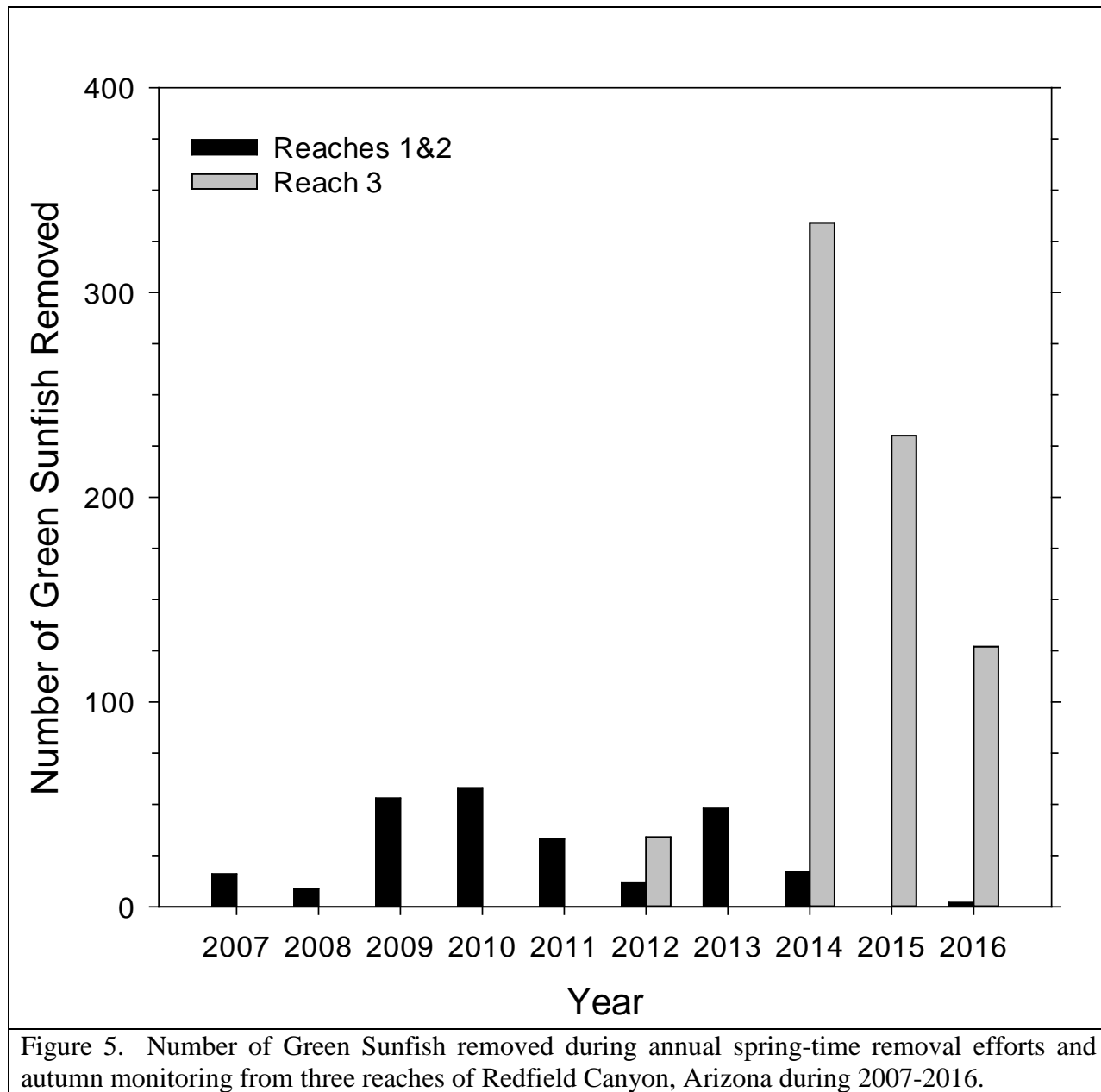
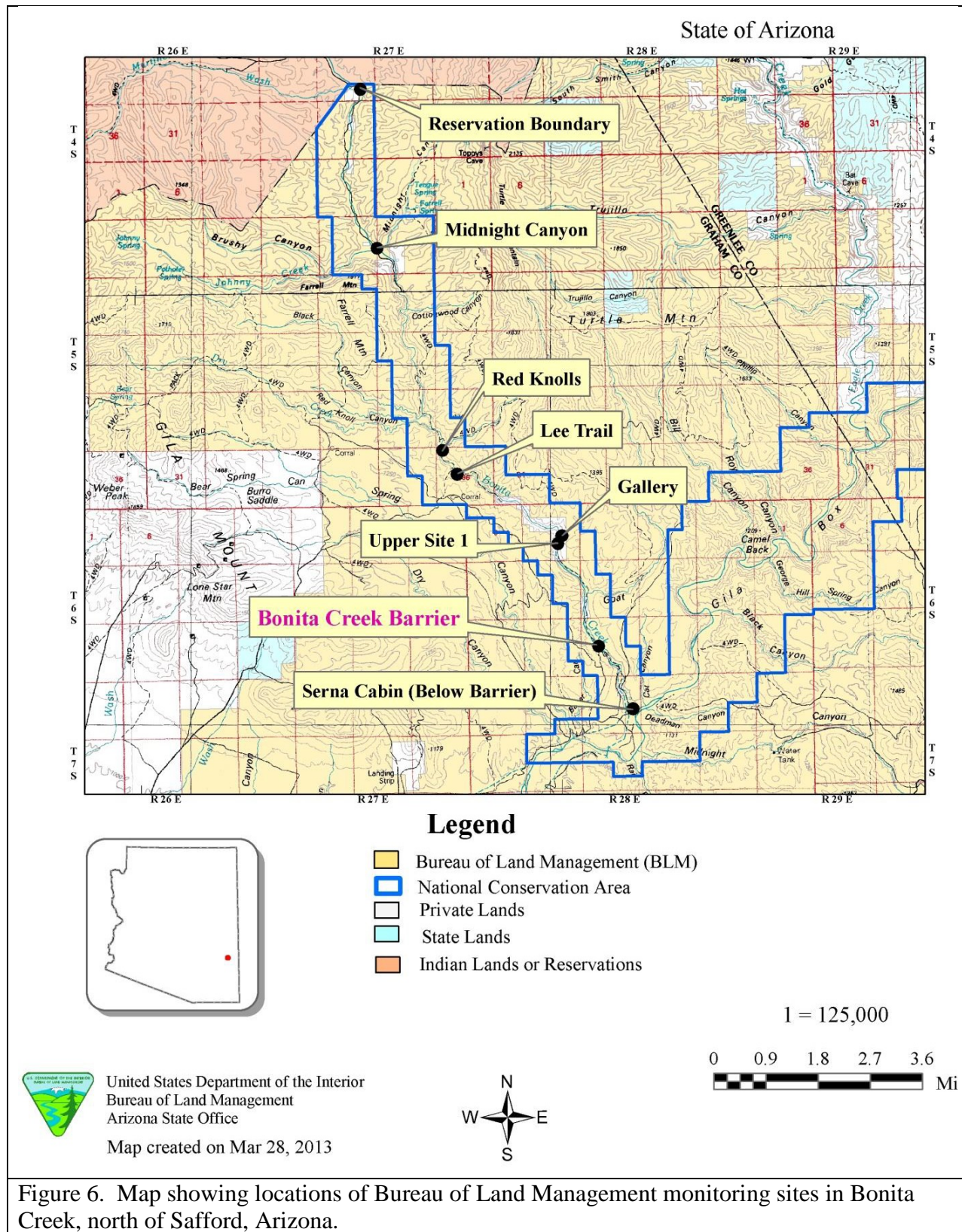


Figure 4. Length frequency distributions in 5-mm classes for Spikedace captured during annual monitoring in Hot Springs Canyon, 2011 through 2016.





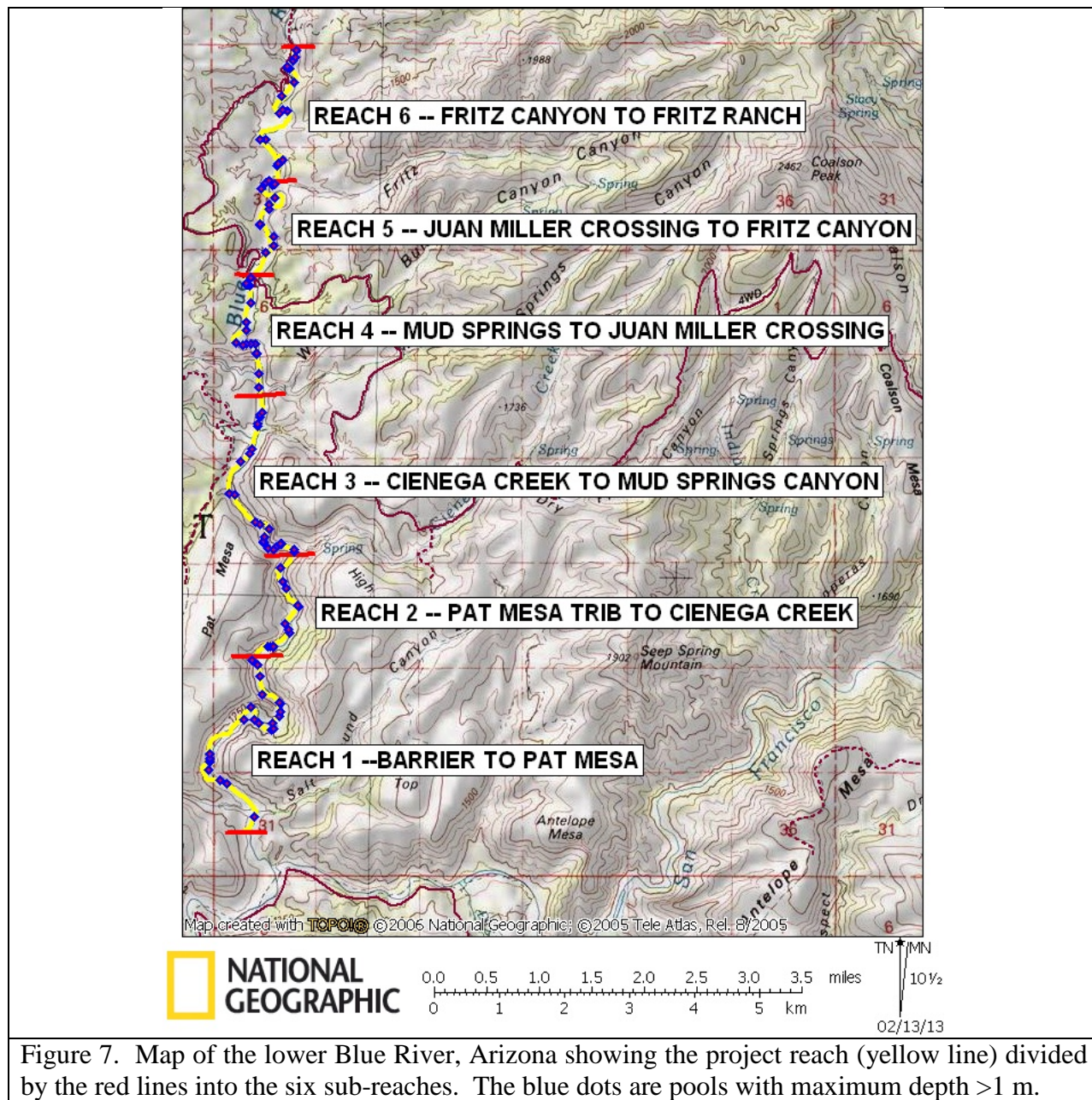
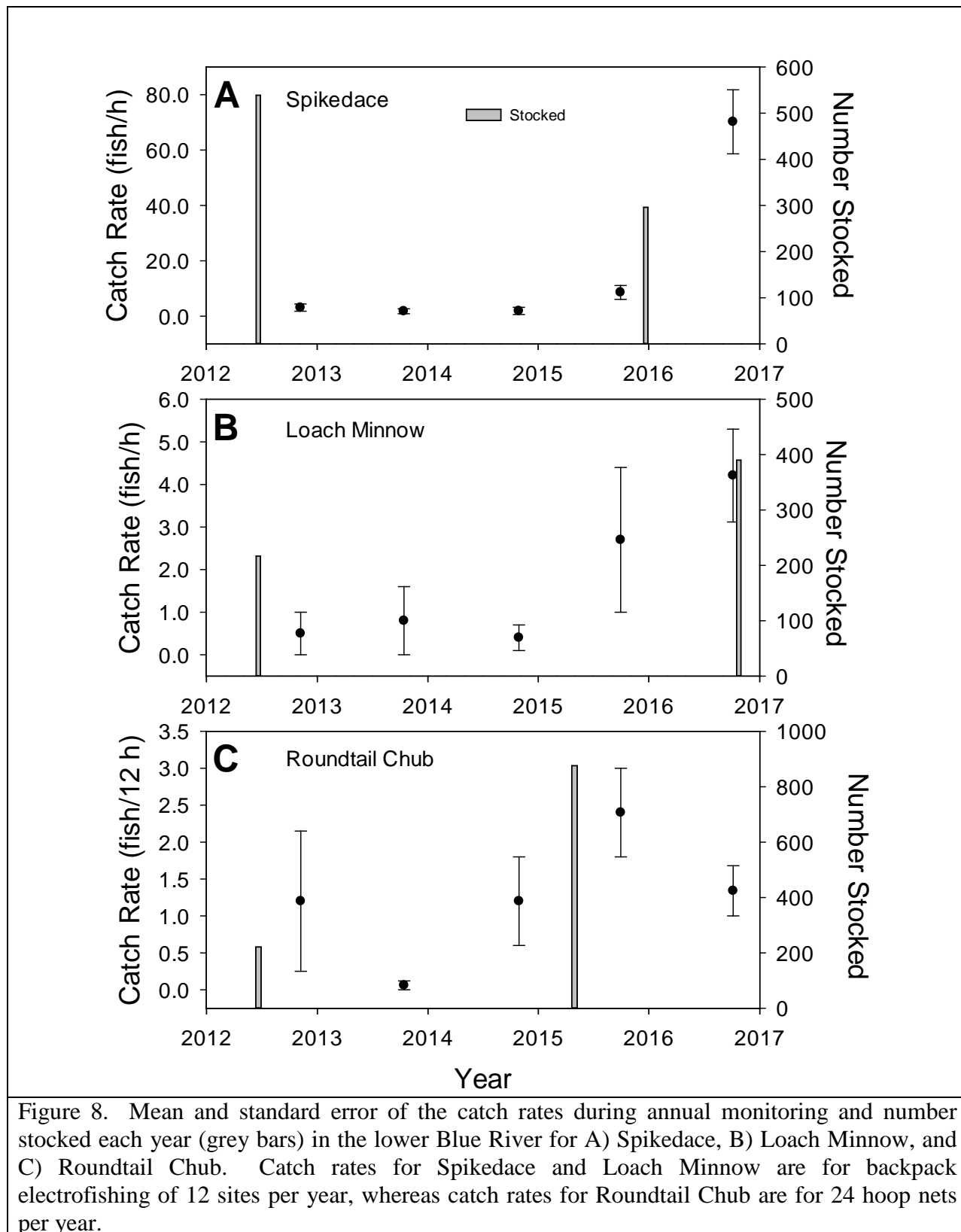


Figure 7. Map of the lower Blue River, Arizona showing the project reach (yellow line) divided by the red lines into the six sub-reaches. The blue dots are pools with maximum depth >1 m.



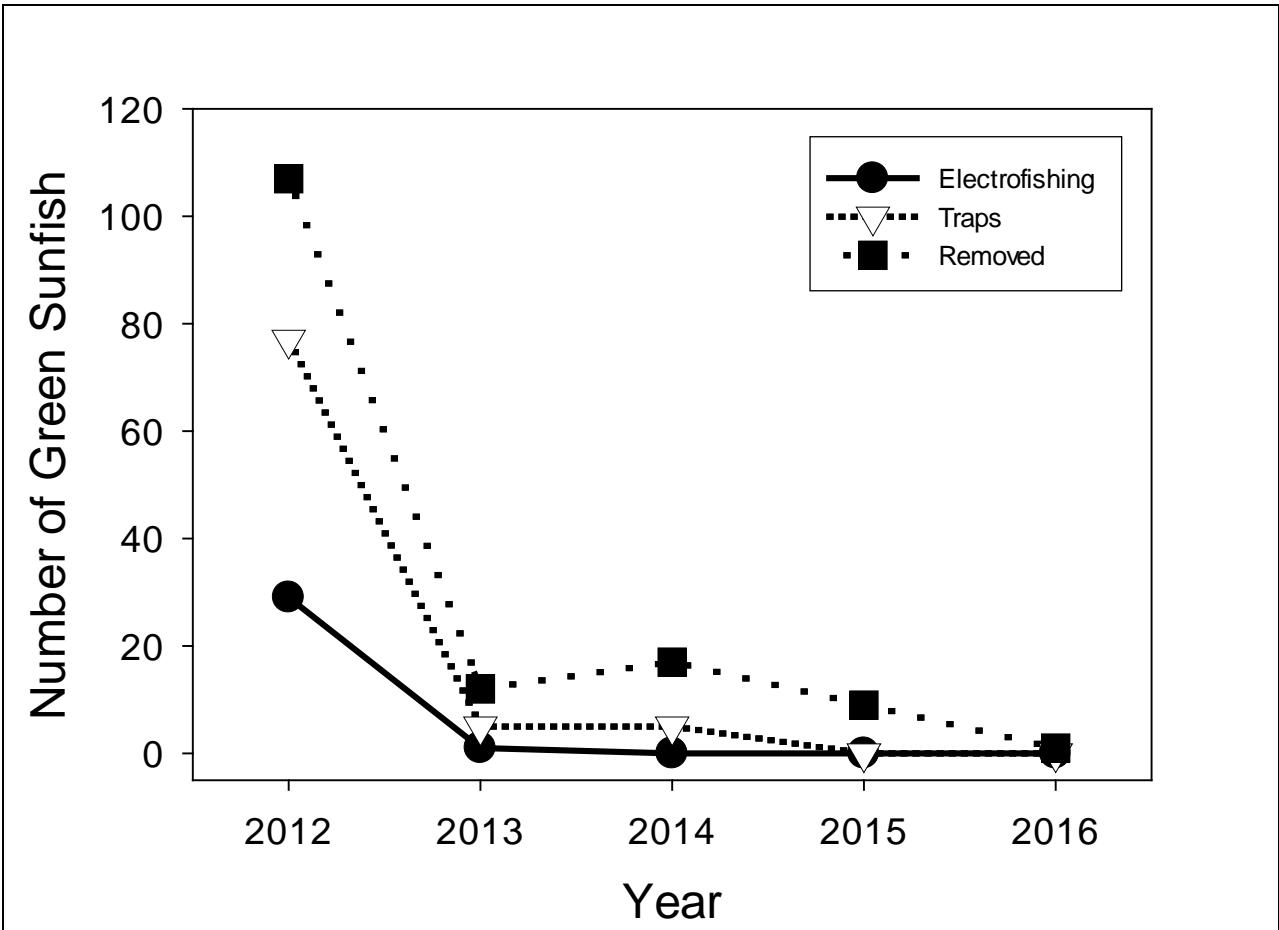
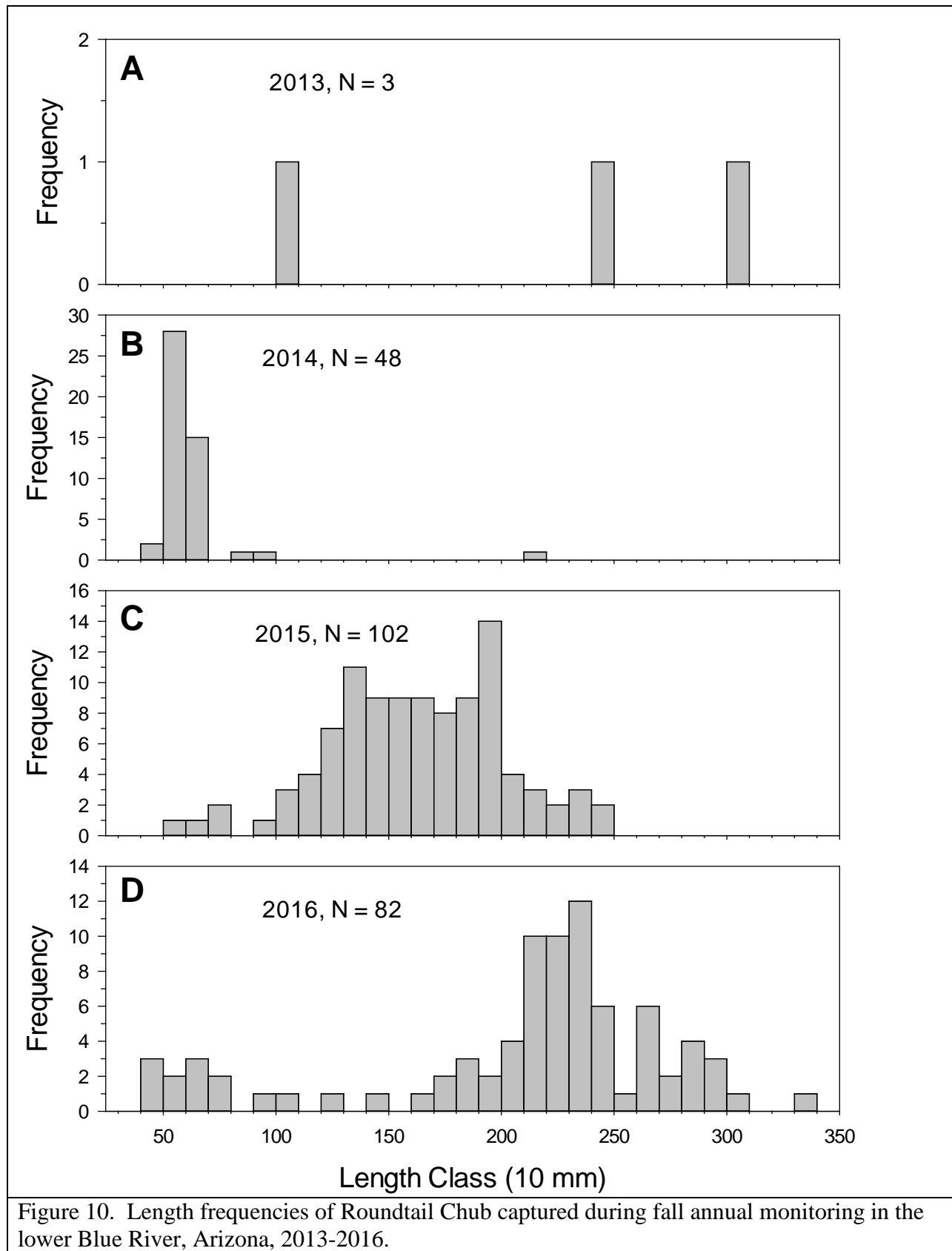
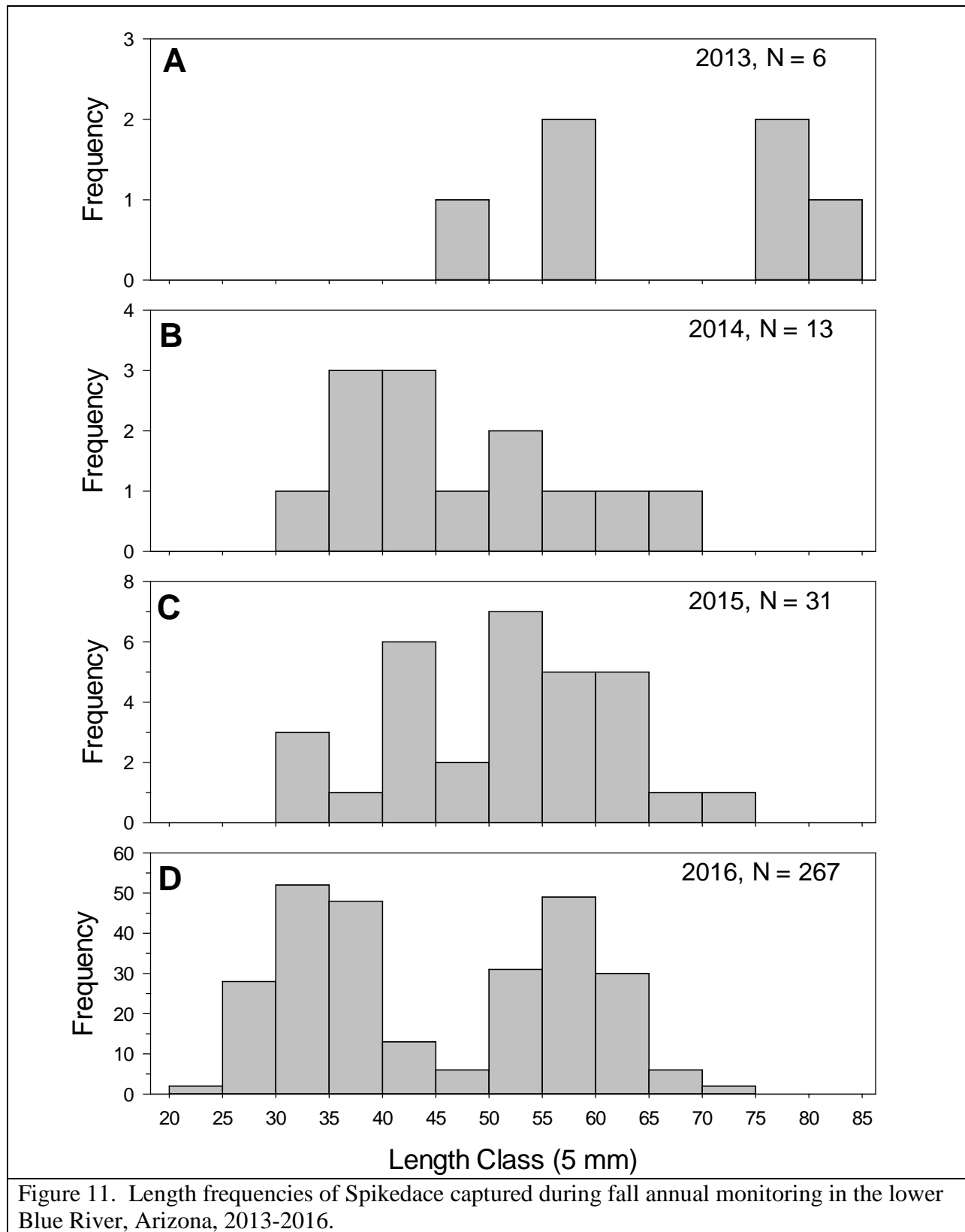
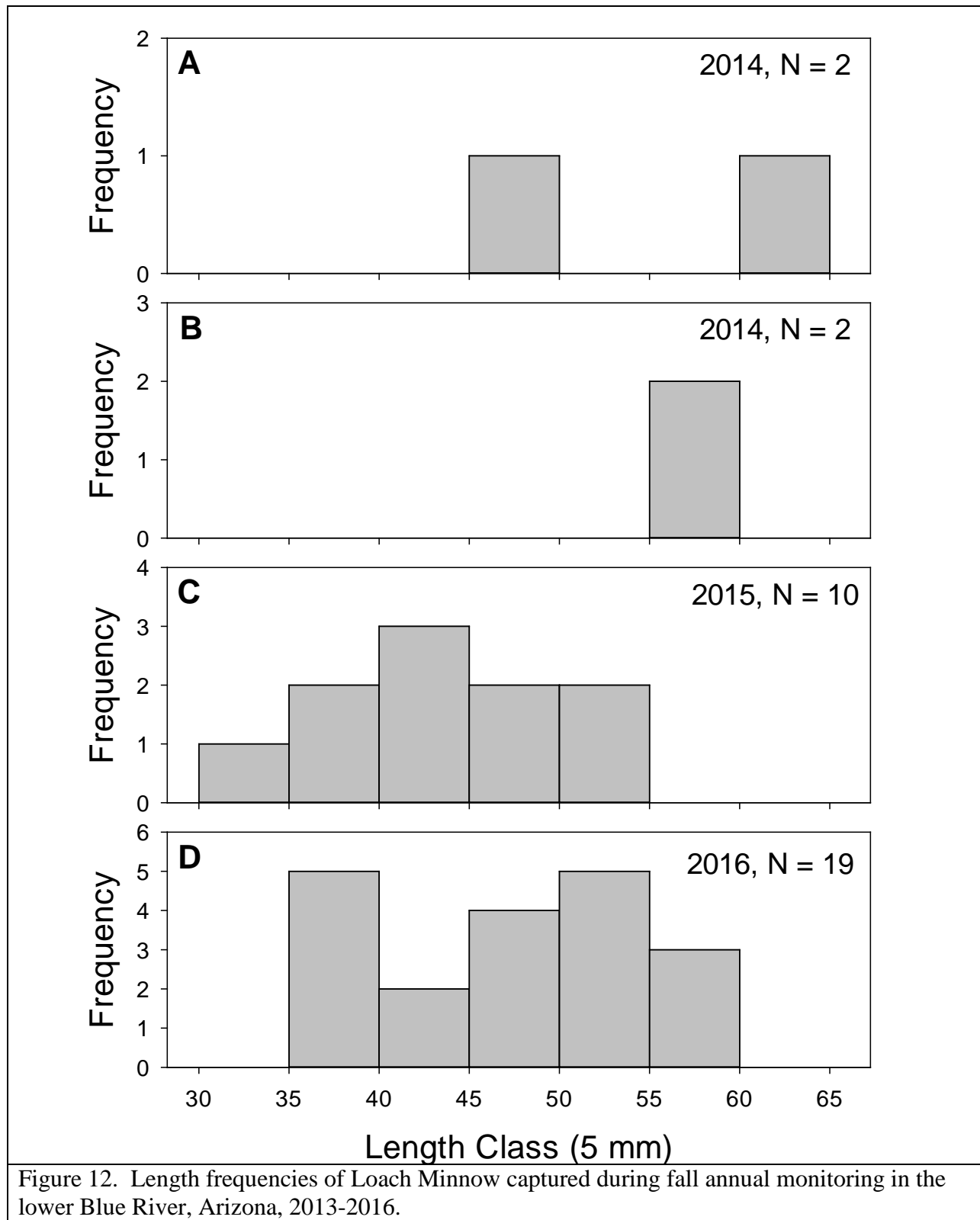


Figure 9. Trends in Green Sunfish catch during annual monitoring (electrofishing and hoop nets) and total number of individuals removed each year, during all activities, from the lower Blue River, Arizona, 2012 thru 2016.









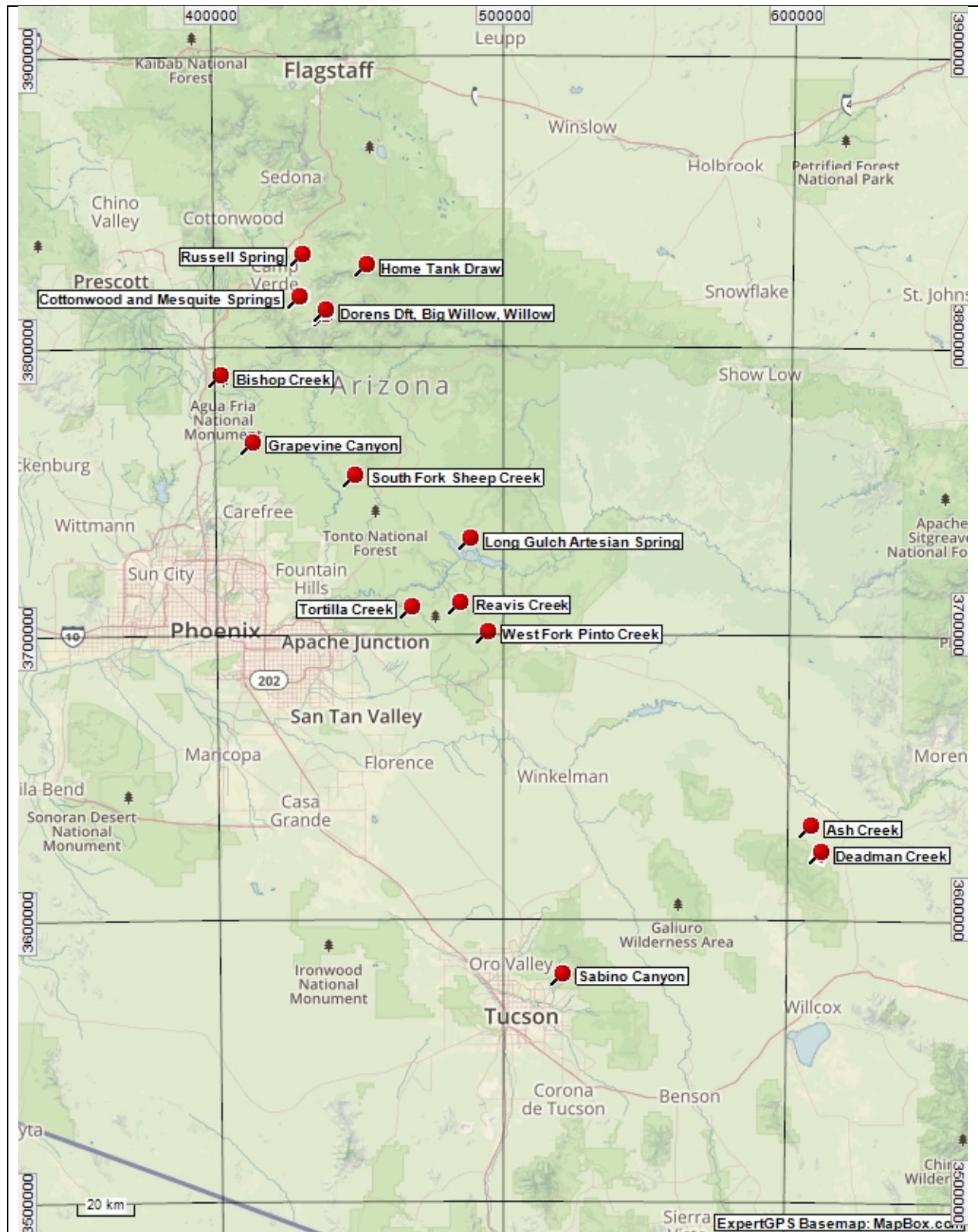


Figure 13. Map showing locations in Arizona where habitat was assessed in 2016 to determine suitability for native fish repatriations.

## APPENDIXES

### Appendix 1. Summary of native fish stocked in Arizona during 2016 by the Department under the Gila River Basin Native Fishes Conservation Program.

Taxa	Water Name	Site Name	Easting	Northing	Date	Lineage	# Stocked	# Mortalities
Desert Pupfish	Las Cienegas-Crescent Pond		538105	3517836	8/29/2016	Santa Clara Slough	252	4
Desert Pupfish	Las Cienegas-Egret Pond		538072	3517757	8/29/2016	Santa Clara Slough	216	7
Desert Pupfish	Muleshoe CMA-Mint Spring		571574	3579364	10/12/2016	Santa Clara Slough	292	0
Gila Topminnow	Muleshoe CMA-Bass Canyon		570829	3579737	10/12/2016	Bylas Spring	533	8
Gila Topminnow	Hidden Water Spring	Lower Pool	459255	3717074	7/22/2016	Lower Santa Cruz	106	4
Gila Topminnow	Hidden Water Spring	Upper Pool	459276	3717174	7/22/2016	Lower Santa Cruz	438	1
Gila Topminnow	Horseshoe Ranch Pond		402818	3791703	6/3/2016	Sharp Spring	247	1
Gila Topminnow	Las Cienegas-Bill's Pond		537981	3516423	8/29/2016	Cienega Creek	841	0
Gila Topminnow	Las Cienegas-Clyne Pond		546711	3514452	8/30/2016	Cienega Creek	541	3
Gila Topminnow	Sabino Canyon	The Crack	520332	3578243	8/30/2016	Cienega Creek	985	24
Gila Topminnow	San Rafael Cattle Co. Pasture 9 Tank		542931	3471363	9/16/2016	Sharp Spring	643	4
Gila Topminnow	Sheepshead Canyon	Upper Pool	414603	3845323	10/18/2016	Lower Santa Cruz	216	0
Gila Topminnow	Sheepshead Canyon	Lower Pool	414831	3844828	10/18/2016	Lower Santa Cruz	440	7
Gila Topminnow	Spring Creek	Above Willow Point Road	416142	3847290	10/18/2016	Lower Santa Cruz	341	1
Gila Topminnow	Spring Creek	Above Fish Barrier	416612	3845845	10/18/2016	Lower Santa Cruz	347	2

Loach Minnow	Blue River	Juan Miller Rd	668021	3685124	10/24/2016	Blue River	390	0
Longfin Dace	Rock Creek (Three Bar WA)	Lower Pool	476011	3730934	7/8/2016	Hidden Water Spring	169	10
Longfin Dace	Rock Creek (Three Bar WA)	Upper Pool	475980	3730962	7/8/2016	Hidden Water Spring	95	0
Roundtail Chub	Blue River	Below The Box Waterfall	667293	3713502	8/26/2016	Eagle Creek	566	0
Roundtail Chub	Blue River	Coleman Flat	667148	3713175	8/26/2016	Eagle Creek	628	0
Roundtail Chub <sup>1</sup>	Las Cienegas-Clyne Pond		546711	3514452	8/30/2016	Cienega Creek	76	3
Spikedace	Spring Creek	Above Willow Point Rd Crossing	416167	3867331	10/18/2016	Aravaipa Creek	67	0

---

<sup>1</sup> Chub repatriated to Clyne Pond were previously classified as Gila Chub.

Appendix 2. Summary of monitoring results during 2016 for each of the five priority species that were previously stocked into various waters in the Gila River Basin Arizona.

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
Razorback Sucker	Fossil Creek	8/15/2016	Snorkeling	47	#Ind	0
					%YOY	
					Mean CPUE	
					SE	
Longfin Dace	Fossil Creek (Reach 4)	8/15/2016	Snorkeling	47	#Ind	6
					%YOY	0
					Mean CPUE	0.34
					SE	0.26
Roundtail Chub	Blue River	10/5/2016	Hoop net	24	#Ind	52
					%YOY	13
					Mean CPUE	1.34
					SE	0.34
Loach Minnow	Blue River	10/4/2016	Backpack Electrofisher	12	#Ind	19
					%YOY	37
					Mean CPUE	4.21
					SE	1.09
Loach Minnow	Bonita Creek	9/29/2016	Backpack Electrofisher	3	#Ind	0
					%YOY	
					Mean CPUE	
					SE	
Loach Minnow	Fossil Creek (Reach 1)	8/1/2015	Snorkeling	6	#Ind	0
					%YOY	
					Mean CPUE	
					SE	
Loach Minnow	Hot Springs Canyon	9/19/2016	Backpack Electrofisher	9	#Ind	70
					%YOY	
					Mean CPUE	59.85
					SE	34.23

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
Loach Minnow	Redfield Canyon	9/20/2016	Backpack Electrofisher	7	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Spikedace	Blue River	10/5/2016	Backpack Electrofisher	12	#Ind	269
					% YOY	53
					Mean CPUE	70.2
					SE	11.56
Spikedace	Fossil Creek (reach 4)	8/15/2015	Snorkeling	47	#Ind	47
					% YOY	4.2
					Mean CPUE	5.05
					SE	1.77
Spikedace	Hot Springs Canyon	9/19/2016	Backpack Electrofisher	9	#Ind	1
					% YOY	0
					Mean CPUE	1.46
					SE	1.46
Spikedace	Redfield Canyon	9/20/2016	Backpack Electrofisher	7	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Spikedace	Spring Creek	9/12/2012	Backpack Electrofisher	3	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	Fossil Creek (Reach 4)	8/15/2016	Snorkeling	47	#Ind	16
					% YOY	0
					Mean CPUE	0.13
					SE	0.07
Gila Topminnow	Las Cienegas-Clyne Pond	8/22/2016	Minnow Trap	10	#Ind	0
					% YOY	



Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
					Mean CPUE	
					SE	
Gila Topminnow	Las Cienegas-Empire Tank	8/22/2016	Minnow Trap	9	#Ind	1722
					% YOY	30
					Mean CPUE	76.40
					SE	18.95
Gila Topminnow	Las Cienegas-Egret Pond	8/22/2016	Minnow Trap	10	#Ind	1757
					% YOY	33
					Mean CPUE	251.73
					SE	163.94
Gila Topminnow	Las Cienegas-Egret Pond	8/22/2016	Dip Net	1	#Ind	27
					% YOY	100
					Mean CPUE	-
					SE	-
Gila Topminnow	Las Cienegas-Crescent Pond	8/22/2016	Minnow Trap	6	#Ind	646
					% YOY	20
					Mean CPUE	30.86
					SE	20.97
Gila Topminnow	Las Cienegas-Crescent Pond	8/22/2016	Dip Net	2	#Ind	118
					% YOY	67
					Mean CPUE	114.86
					SE	63.51
Gila Topminnow	Las Cienegas-Gaucha Tank	8/23/2016	Minnow Trap	10	#Ind	1132
					% YOY	16
					Mean CPUE	47.27
					SE	6.13
Gila Topminnow	Las Cienegas-Spring Water Wetland	8/23/2016	Minnow Trap	10	#Ind	12112
					% YOY	41
					Mean CPUE	331.22
					SE	58.44

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
Gila Topminnow	Little Nogales Spring	8/23/2016	Minnow Trap	10	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	Nogales Spring	8/23/2016	Minnow Trap	10	#Ind	5
					% YOY	0
					Mean CPUE	0.26
					SE	0.16
Gila Topminnow	San Pedro Riparian NCA-Ben Spring	8/8/2016	Seine	2	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	San Pedro Riparian NCA-Murray Spring	8/8/2016	Minnow Trap	10	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	San Pedro Riparian NCA-Murray Spring	8/8/2016	Dip Net	6	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	San Pedro Riparian NCA-Horse Thief Draw	8/22/2016	Seine	6	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	San Pedro Riparian NCA-Horse Thief Draw	8/22/2016	Dip Net	3	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	Robbins Butte Swimming Pool Tank	4/6/2016	Minnow Trap	5	#Ind	91
					% YOY	0

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
					Mean CPUE	8.81
					SE	4.01
Gila Topminnow	Robbins Butte Stop Sign Tank	4/6/2016	Minnow Trap	10	#Ind	1
					% YOY	0
					Mean CPUE	0.05
					SE	0.05
Gila Topminnow	Robbins Butte Stop Sign Tank	7/7/2016	Minnow Trap	7	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Gila Topminnow	Rock Spring	7/25/2016	Minnow Trap	10	#Ind	251
					% YOY	44
					Mean CPUE	11.09
					SE	3.79
Gila Topminnow	Rock Spring	7/25/2016	Seine	1	#Ind	521
					% YOY	33
					Mean CPUE	173.67
					SE	-
Gila Topminnow	Rock Spring	7/25/2016	Dip Net	3	#Ind	22
					% YOY	64
					Mean CPUE	29.33
					SE	29.33
Gila Topminnow	Sabino Canyon	6/28/2016	Minnow Trap	24	#Ind	67
					% YOY	45
					Mean CPUE	1.28
					SE	0.86
Gila Topminnow	Sabino Canyon	6/28/2016	Dip Net	10	#Ind	5
					% YOY	100
					Mean CPUE	-
					SE	-

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
Gila Topminnow	Sheepshead Canyon	9/12/2016	Minnow Trap	10	#Ind	2
					% YOY	0
					Mean CPUE	0.03
					SE	0.02
Gila Topminnow	Spring Creek	9/12/2016	Minnow Trap	16	#Ind	1
					% YOY	0
					Mean CPUE	0.03
					SE	0.1
Gila Topminnow	Walnut Spring (#392)	6/30/2016	Minnow Trap	10	#Ind	62
					% YOY	2
					Mean CPUE	2.84
					SE	1.19
Gila Topminnow	Walnut Spring (#392)	6/30/2016	Dip Net	2	#Ind	13
					% YOY	-
					Mean CPUE	17.57
					SE	12.16
Desert Pupfish	Las Cienegas-Empire Tank	8/22/2016	Minnow Trap	9	#Ind	223
					% YOY	17
					Mean CPUE	9.83
					SE	3.99
Desert Pupfish	Las Cienegas-Cottonwood Tank	8/22/2016	Minnow Trap	11	#Ind	34
					% YOY	9
					Mean CPUE	1.07
					SE	0.36
Desert Pupfish	Las Cienegas-Cottonwood Tank	8/22/2016	Dip Net	4	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Desert Pupfish	Las Cienegas-Egret Pond	8/22/2016	Minnow Trap	10	#Ind	45
					% YOY	36

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
					Mean CPUE	8.70
					SE	6.84
Desert Pupfish	Las Cienegas-Egret Pond	8/22/2016	Dip Net	1	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Desert Pupfish	Las Cienegas-Crescent Pond	8/22/2016	Minnow Trap	6	#Ind	19
					% YOY	5
					Mean CPUE	0.90
					SE	0.73
Desert Pupfish	Las Cienegas-Crescent Pond	8/22/2016	Dip Net	2	#Ind	0
					% YOY	
					Mean CPUE	
					SE	
Desert Pupfish	Las Cienegas-Heart Pond	8/22/2016	Minnow Trap	6	#Ind	73
					% YOY	33
					Mean CPUE	5.83
					SE	3.52
Desert Pupfish	Las Cienegas-Gaucha Tank	8/23/2016	Minnow Trap	10	#Ind	56
					% YOY	4
					Mean CPUE	2.37
					SE	0.87
Desert Pupfish	Las Cienegas-Cinco Canyon Tank	8/23/2016	Minnow Trap	10	#Ind	761
					% YOY	20
					Mean CPUE	27.68
					SE	8.04
Desert Pupfish	San Pedro Riparian NCA-Little Joe Spring	8/8/2016	Minnow Trap	10	#Ind	812
					% YOY	7
					Mean CPUE	37.18
					SE	7.00

Taxa	Location	Date	Gear Type	Sample Size	Statistics	2016
Desert Pupfish	San Pedro Riparian NCA-Little Joe Spring	8/8/2016	Dip Net	5	#Ind % YOY Mean CPUE SE	0
Desert Pupfish	San Pedro Riparian NCA-Murray Spring	8/8/2016	Minnow Trap	10	#Ind % YOY Mean CPUE SE	0
Desert Pupfish	San Pedro Riparian NCA-Murray Spring	8/8/2016	Dip Net	6	#Ind % YOY Mean CPUE SE	0
Desert Pupfish	San Pedro Riparian NCA-Horse Thief Draw	8/22/2016	Seine	6	#Ind % YOY Mean CPUE SE	0
Desert Pupfish	San Pedro Riparian NCA-Horse Thief Draw	8/22/2016	Dip Net	3	#Ind % YOY Mean CPUE SE	0

Appendix 3. Populations of threatened and endangered species repatriated under the Gila River Basin Native Fishes Conservation Program, 2007 through 2016. Estimated population size is given for those considered established (i.e., reproducing to the point that they are self-sustaining). Topminnow and pupfish begin reproducing during their first year of life, so populations that have increased in numbers and continue to persist for three years after the final stocking are considered established. Spikedace, Loach Minnow, and Longfin Dace begin reproducing at age-1, and have a life span of about three years, so can probably be considered established if there is evidence of reproduction and increase in population over three to four years after the final stocking. Roundtail chub begin reproducing at age-1 or age-2, and live for about eight years, so it is probably necessary to monitor for five years after the final stocking before a relatively confident assessment of establishment can be made. The population size was estimated based catch during the most recent monitoring and size of stream or pond.

Species	Metapopulation	Lineage	Replicated Locations	Year Replicated	Population Status/Size		
Gila Topminnow	Bylas Spring Complex	Bylas Spring	Bass Canyon (Muleshoe Ranch CMA)	2014-2016	TBD		
			Bonita Creek (lower)	2008	100-500		
			Bonita Creek (upper)	2010-2015	10000-15000		
			Burro Cienega, NM	2008	1000-5000		
			Headquarters Spring (Muleshoe Ranch CMA)	2008	500-1000		
			Howard Well	2008	1000-5000		
			Kei Sundt pond	2012	500-1000		
			Redfield Canyon (Muleshoe Ranch CMA)	~2009	1000-5000		
			Redrock Wildlife Area Pond, NM	2010-2011	Failed		
			Secret Spring (Muleshoe Ranch CMA)	2007	1000-5000		
			Swamp Spring (Muleshoe Ranch CMA)	2007-2008	1000-5000		
			TNC Lower San Pedro Preserve's west pond	2006	5000-10000		
			Wildcat Canyon (Muleshoe Ranch CMA)	2014	TBD		
			Upper Santa Cruz	Sharp Spring	Buckhorn Spring	2011	1000-5000
					Chalky Spring	2009	0-100
Fossil Creek	2007-2010	5000-10000					
Morgan City Wash	2009	500-1000					
Page Springs Hatchery SRP Topminnow Pond	2009	5000-10000					
Robbins Butte Stop Sign Tank	2015	TBD					

Species	Metapopulation	Lineage	Replicated Locations	Year Replicated	Population Status/Size
			Robbins Butte Swimming Pool Tank	2015	TBD
			San Rafael Cattle Company Pasture #2 Pond	2013	500-1000
			San Rafael Cattle Company Pasture #9 Pond	2016	TBD
	Lower Santa Cruz	Peck Canyon	Hidden Water Spring	2016	TBD
			Phoenix Zoo Ranarium	2012	1000-5000
			Rock Spring	2013-2014	500-1000
			Sheepshead Canyon	2014-2016	TBD
			Spring Creek	2015-2016	TBD
		Redrock Canyon	Walnut Spring (#392)	2012-2013	500-1000
	Monkey&Cottonwood	Cottonwood Spr	Ben Spring (San Pedro Riparian NCA)	2011	Failed
			Cottonwood Spring (Goldfield Mountains)	2008	250-500
			Horse Thief Draw (San Pedro Riparian NCA)	2011	Failed
			Murray Spring (San Pedro Riparian NCA)	2011-2014	TBD
		Monkey Spring	Pemberton Pond (McDowell Mountain Reg. Park)	2009	Failed
			Spur Cross Ranch Cons. Area Solar Oasis pond	2009	Failed
			Usery Mountain Regional Park pond	2011	500-1000
			Willow Spring (San Pedro Riparian NCA)	2009	Failed
	Cienega Creek	Cienega Creek	Bill's Wildlife Pond (Las Cienegas NCA)	2016	TBD
			Clyne Tank (Las Cienegas NCA)	2015-2016	TBD
			Crescent Pond (Las Cienegas NCA)	2013	1000-5000
			Egret Pond (Las Cienegas NCA)	2013	1000-5000
			Empire Tank (Las Cienegas NCA)	2013	1000-5000
			Gaicho Wildlife Pond (Las Cienega NCA)	2014	TBD
			Little Nogales Spring (Las Cienegas NCA)	2012	Failed
			Nogales Spring (Las Cienegas NCA)	2012-2015	TBD
			Road Canyon Tank (Las Cienegas NCA)	2012	1000-5000
			Sabino Canyon	2015-2016	TBD
			Spring Water Wetland (Las Cienegas NCA)	2013	5000-10000
Desert Pupfish	Santa Clara/El Doctor		Bonita Creek (lower)	2008	Failed



Species	Metapopulation	Lineage	Replicated Locations	Year Replicated	Population Status/Size
			Bonita Creek (upper)	2010-2015	TBD
			Cinco Canyon Tank (Las Cienegas NCA)	2013	1000-5000
			Cherry Spring Canyon (Muleshoe Ranch CMA)	2007	Failed
			Cottonwood Pond (Las Cienegas NCA)	2013	500-1000
			Crescent Pond (Las Cienegas NCA)	2013	500-1000
			Egret Tank (Las Cienegas NCA)	2015-2016	TBD
			Empire Tank (Las Cienegas NCA)	2013	500-1000
			Gauche Wildlife Pond (Las Cienegas NCA)	2015	TBD
			Headquarters Spring (Muleshoe Ranch CMA)	2008	Failed
			Heart Pond (Las Cienegas NCA)	2013	500-1000
			Horse Thief Draw (San Pedro Riparian NCA)	2011	Failed
			Howard Well	2008-2009	100-250
			Kei Sundt Pond	2010	100-500
			Larry & Charlie Tank (Muleshoe Ranch CMA)	2009	100-250
			Little Joe Spring (San Pedro Riparian NCA)	2013	1000-5000
			Mint Spring (Muleshoe Ranch CMA)	2015-2016	TBD
			Mud Spring (#18)	2007-2009	100-500
			Murray Spring (San Pedro Riparian NCA)	2011-2014	TBD
			Nursery Tank (McDowell Mnt. Regional Park)	2010	1000-5000
			Pemberton Pond (McDowell Mountain Reg. Park)	2009	100-250
			Road Canyon Tank (Las Cienegas NCA)	2012	500-1000
			Robbins Butte Wildlife Area Cottonwood Tank	2010	1000-5000
			Robbins Butte Wildlife Area Twin Tanks	2009	1000-5000
			Secret Spring (Muleshoe Ranch CMA)	2007-2011	100-250
			Spur Cross Ranch Cons. Area Solar Oasis pond	2009	500-1000
			Swamp Spring (Muleshoe Ranch CMA)	2007	Failed
			TNC Lower San Pedro Preserve's east pond	2009	5000-10000
			Tule Creek	2007-2009	Failed
			Walnut Spring (#20)	2008	Failed

Species	Metapopulation	Lineage	Replicated Locations	Year Replicated	Population Status/Size
Longfin Dace		Coal Mine Canyon	Fresno Canyon	2008	1000-5000
		Hassayampa River	Arnett Creek	2007	500-1000
		Hassayampa River	Telegraph Canyon	2007	500-1000
		Hidden Water Spr	Rock Creek	2016	TBD
		Seven Sprs Wash	Spur Cross Ranch Cons. Area Solar Oasis pond	2008	0-100
		Tangle Creek	Fossil Creek	2008-2009	1000-5000
Loach Minnow	Aravaipa Creek	Hot Springs Canyon		2007-2011	250-500
		Bonita Creek (lower)		2008	Failed
		Bonita Creek (upper)		2009-2014	TBD
		Redfield Canyon (Muleshoe Ranch CMA)		2007-2010	Failed
		Fossil Creek		2007-2013	Failed
Spikedace	Aravaipa Creek	Fossil Creek		2007-2012	1000-5000
		Spring Creek		2015-2016	TBD
		Hot Springs Canyon		2007-2011	TBD
		Redfield Canyon (Muleshoe Ranch CMA)		2007-2010	Failed
	Upper Gila River	Blue River		2012	1000-5000
		Bonita Creek (lower)		2008	Failed
Bonita Creek (upper)			2009-2010	Failed	
Roundtail Chub	Eagle Creek	Blue River		2012-2016	TBD
	Harden Cienega <sup>1</sup>	upper Harden Cienega		2015	TBD
	Verde River	TNC Gila Riparian Preserve (Farm), NM		2008	Failed
	O'Donnell Creek <sup>1</sup>	TNC Lower San Pedro Preserve's west pond		2010-2011	1000-5000
	Harden Cienega <sup>1</sup>	Mule Creek NM		2012-2014	TBD
	Redfield Canyon <sup>1</sup>	upper Redfield Canyon		2007	TBD
	Dix Creek <sup>1</sup>	Redrock Wildlife Area, NM		2010-2011	Failed
Razorback Sucker	Lake Mohave	Fossil Creek		2008-2014	Failed

<sup>1</sup> Chub in these locations were previously classified as Gila Chub.

Appendix 4. Waters assessed during 2017 to determine suitability for native fish repatriations, showing coordinates (NAD 83 UTM, zone 12S) of the upstream and downstream points for each reach assessed, the estimated length of perennial water within the assessed reach at the time of the survey, and the species for which the water was considered be suitable for.

Year	Date	Water Name	Upstream		Downstream		Length Perennial (m)	Suitable for Species
			Easting	Northing	Easting	Northing		
2016	2/19/2016	Bishop Creek	401782	3789224	403890	3788175	30	Maybe POOC
2016	2/27/2016	Grapevine Canyon	412756	3766285	412770	3766280	500	POOC, GIRO
2016	3/7/2016	Tortilla Creek	467373	3708578	464233	3710019	500	POOC
2016	3/15/2016	South Fork Sheep Creek	448077	3754778	446914	3756529	100	POOC
2016	4/12/2016	Ash Creek	607829	3632197	607789	3632123	?	Maybe AGCH
2016	4/12/2016	Deadman Creek	611373	3623016	611398	3623118	?	Maybe GIRO
2016	6/5/2016	Home Tank Draw	452192	3827223	452117	3826994	25	None
2016	6/8/2016	Russell Spring	430492	3831022	429941	3831305	59	None
2016	6/28/2016	Sabino Canyon	520661	3579809	520551	3579167	700	GIRO, CACL, RHOS
2016	7/6/2016	Mesquite Spring	429471	3816410	428902	3815864	4	None
2016	7/6/2016	Cottonwood Spring	429239	3816482	429063	3816016	0	None
2016	7/6/2016	Doren's Defeat Spring	438093	3810597	436636	3811691	15	None
2016	7/6/2016	Willow Spring	438429	3811400	436636	3811691	10	None
2016	7/6/2016	Big Willow Spring	437993	3811651	437803	3811414	6	None
2016	7/26/2016	Long Gulch Artesian	487919	3732399			10	None
2016	10/20/2016	West Fork Pinto Creek	493978	3699996	495059	3700174	1070	POOC, GIRO, CACL
2016	11/2/2016	Reavis Creek	484483	3710381	484521	3711190	500	Maybe POOC, GIRO