

Horseshoe and Bartlett Reservoirs Habitat Conservation Plan Annual Report 2013



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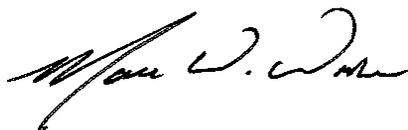
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CERTIFICATION

Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate, and complete.



January 24, 2014

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Date

1. Introduction

On May 30, 2008, the U.S. Fish and Wildlife Service (FWS) issued an Incidental Take Permit (ITP) pursuant to Section 10(a)(1)(B) of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, to Salt River Project (SRP) for southwestern willow flycatcher (*Empidonax traillii extimus*) (“flycatcher”), yellow-billed cuckoo (*Coccyzus americanus*) (“cuckoo”), bald eagle (*Haliaeetus leucocephalus*), razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychocheilus lucius*), Gila topminnow (*Peociliopsis occidentalis occidentalis*), spikedace (*Meda fulgida*), loach minnow (*Tiaroga cobitis*), roundtail chub (*Gila robusta*), longfin dace (*Agosia chrysogaster*), Sonora sucker (*Catostomus insignis*), desert sucker (*Catostomus clarki*), speckled dace (*Rhinichthys osculus*), lowland leopard frog (*Lithobates yavapaiensis*), northern Mexican gartersnake (*Thamnophis eques megalops*), and narrow-headed gartersnake (*Thamnophis rufipunctatus*). The activity covered by the ITP is the continued operation by SRP of Horseshoe and Bartlett dams and reservoirs. The ITP is conditioned upon SRP’s implementation of the Horseshoe and Bartlett Reservoirs Habitat Conservation Plan (“H-B HCP”) (Salt River Project 2008).

The H-B HCP provides measures to minimize and mitigate incidental take of the 16 species listed above “to the maximum extent practicable and ensures that incidental take will not appreciably reduce the likelihood of the survival and recovery of these species in the wild” (FWS 2008). Flycatcher and cuckoo (covered bird) mitigation efforts include operation of Horseshoe Reservoir to support tall dense vegetation at the upper end of the reservoir and off-site acquisition and management of suitable nesting habitat. Minimization and mitigation efforts for covered native fish, frog, and gartersnake (aquatic species) includes operation of Horseshoe Reservoir to minimize non-native fish production, stocking of covered native fish, and supporting stream and water supply protection projects in the Verde River watershed.

2. Annual Reporting Requirements

Obligation: SRP is required to submit an annual report to FWS, City of Phoenix, Arizona Game and Fish Department (AGFD), and U.S. Forest Service (USFS) describing all H-B HCP activities occurring during the past year. A draft report must be sent to FWS prior to the annual meeting in October/November of each year. The report is to be finalized by February 1 of the following year.

Actions: SRP submits this report to the FWS, City of Phoenix, AGFD, and USFS to fulfill the annual reporting requirement. The report covers all activities relating to the H-B HCP from November 1, 2012 through October 31, 2013, including a summary of reservoir operations, management activities, monitoring results, status reports, and planned future activities.

3. Horseshoe Lake Operation ITP Compliance

a. Horseshoe and Bartlett Operation Summary

Obligation: SRP is required in this annual report to provide a summary of reservoir operations.

Action: Below is a summary of reservoir operations from SRP hydrologists of the 2013 water year (October 2012–September 2013).

Summary: The potential to have one of the driest winters in SRP’s history had the greatest influence on Salt and Verde reservoir operations this past water year. The strongest indicator, El Niño Southern Oscillation (ENSO), was in neutral condition, the Pacific Decadal Oscillation

(PDO) was in a negative (cool) phase and the Atlantic Multidecadal Oscillation (AMO) was in positive (warm) phase. These conditions were in place during the winter of 2002 when the Salt and Verde watersheds produced just 106 KAF of runoff which is the lowest amount of inflow into the reservoirs in SRP's history. The runoff this winter was 84% of median; however, 30% of the seasonal volume came from one event beginning in late January. The precipitation this monsoon season on the Salt and Verde watersheds was 126% of normal but runoff volumes from the monsoon season typically do not impact operations. Overall, the watershed received an average of 17.37 inches (95% of normal) during Water Year 2013.

Precipitation: Precipitation during Water Year 2013 may be characterized as a near normal winter preceded by a dry fall and a wet summer monsoon preceded by a very dry spring. That is, the two wet seasons, winter and summer, were normal to wet, but the transition seasons were quite dry.

Ocean surface temperatures in the equatorial Eastern Pacific Ocean were near normal during the winter and neither an El Niño (warmer waters) nor a La Niña (cooler waters) was ever present. Since anomalously warm or cool tropical ocean temperatures are known to influence mid-latitude weather systems affecting the western United States during the cool part of the year, impact from the tropical Eastern Pacific was minimal this winter. Other atmospheric factors, that are less apparent more than a couple weeks ahead of time, dominated Arizona's weather. Fortunately significant multi-day storms appeared over Arizona in mid-December, late January and early March and brought near-normal precipitation to the Salt-Verde watershed (Figure 1).

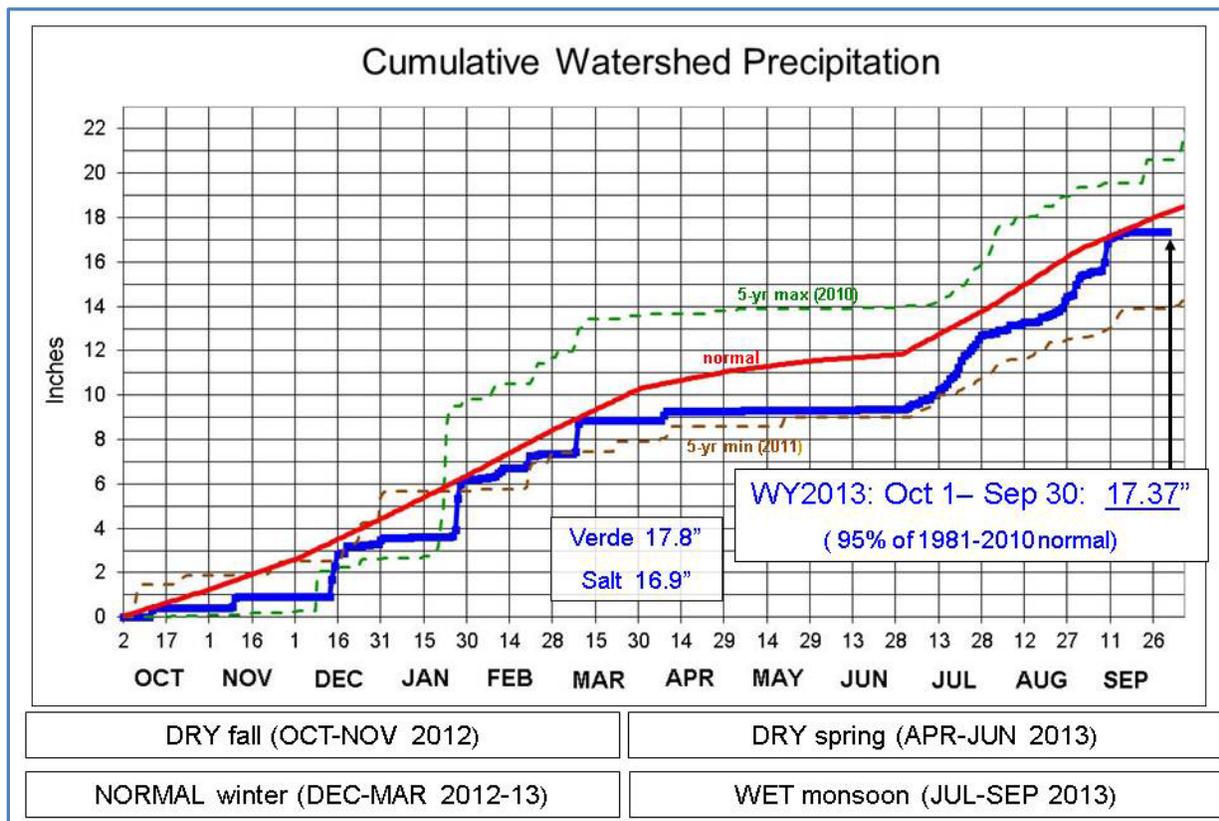


Figure 1: Water Year 2013 Precipitation Graph for the Salt-Verde Watershed.

Winter precipitation was well-balanced between the Verde and Salt watersheds. However, during the summer monsoon, the Verde watershed received significantly more rainfall than did the Salt.

Water Year 2013: December of 2012 was the sixth consecutive December with above normal precipitation. December through March precipitation was the 37th wettest in 113 years of record. A dry spring (32% of normal precipitation) added to the water year deficit that could not be offset by the wet summer (126% of normal rainfall). In all, water year 2013 precipitation of 17.37 inches was 95% of normal. This is 2.65" more than the 14.72 inches that fell during water year 2012.

Reservoir Status: Even though the 2013 winter precipitation (December-March) ranked as the 37th wettest it did not translate to runoff. The 2013 winter produced 449,000 acre-feet from January through May which is 84% of median. This winter represents the third consecutive winter with below median runoff. The 2011, 2012, and 2013 winter seasons were the 23rd, 16th and 39th lowest winter runoff seasons respectively in SRP's history. Runoff from the monsoon (July-September) produced about 165,000 acre-feet. While the precipitation and runoff from this monsoon was above normal it had little impact on SRP's total storage.

Groundwater production was increased to 300,000 acre-feet for calendar year 2013 due to the consecutive very dry years in 2011 and 2012. The 2013 winter runoff provided approximately 250,000 acre-feet more runoff than the previous winter season. The increase in pumping and winter inflow allowed the reservoir system to recover slightly as total storage capacity increased 4% from 52% to 56% during water year 2013. Total runoff for water year 2013 was approximately 691,000 acre-feet (Figure 2).

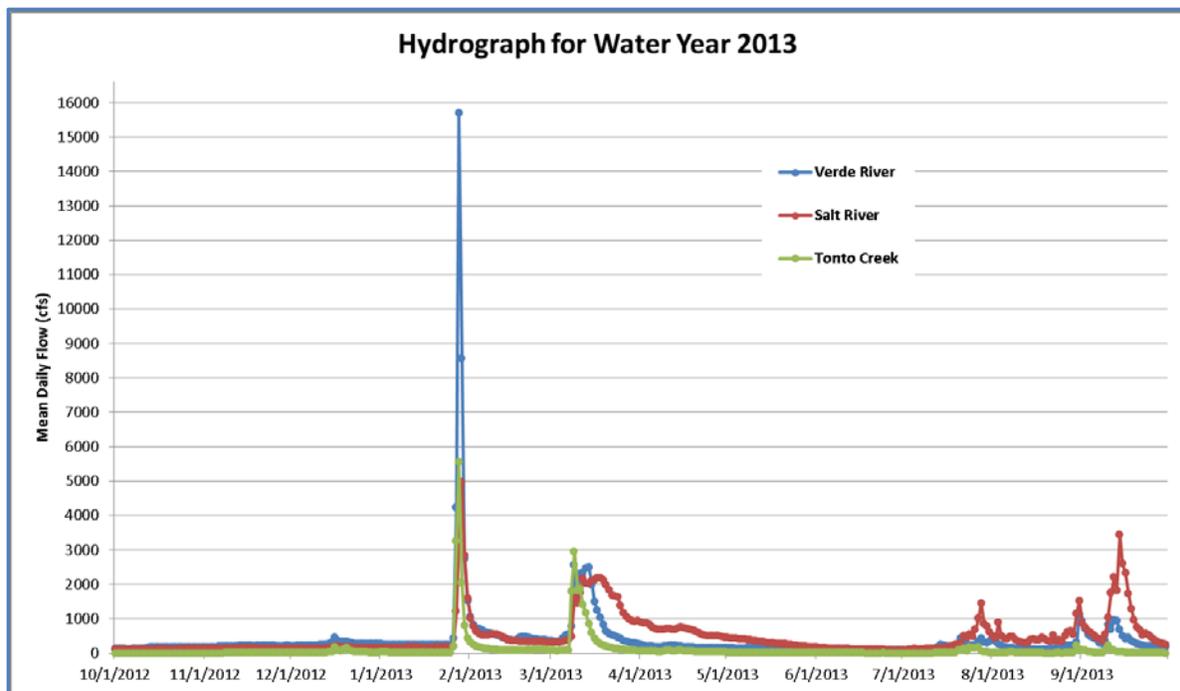


Figure 2: Verde River, Salt River, and Tonto Creek 2013 Water Year Hydrograph
Data from USGS and are preliminary

Reservoir Operations: Climatic conditions matching the driest year in SRP’s history had the greatest influence on reservoir operations. Climatic indicators including ENSO, PDO, and the AMO were in the same phase as they were in 2002 which is the driest runoff year in SRP’s history.

Verde Operations: Typical operations call for the water order to be switched from the Verde system to the Salt system in May leaving Bartlett release at minimum. Water stored behind Horseshoe Dam is also typically moved as soon as possible downstream to Bartlett Reservoir to reduce the amount of loss from seepage and evaporation, and meet H-B HCP objectives. The water order may be switched sooner depending on the winter runoff.

The transition to the Verde system was delayed until mid-November this year to position the Verde system storage at a level that will allow for better system flexibility in anticipation of another dry winter runoff season. The dry watershed conditions and projected below median runoff forecast suggested that the Verde Storage capacity would continue to decrease. However, when the potential for one of the lowest winter runoff forecasts based on the climatic conditions added to the certainty of a meager runoff season on the Verde watershed, the transition from the Salt system to the Verde system was quickly reversed. Bartlett Dam release was returned to minimum by the end of November. The winter runoff produced approximately 183,000 acre feet which is 103% of median. The peak mean daily flow into Horseshoe Reservoir was 15,700 cfs; therefore, Horseshoe Reservoir stored water for most of the winter before being passed downstream to Bartlett Reservoir. The water order was transitioned back to the Verde system in mid-March to expedite the passage of water from Horseshoe Reservoir to Bartlett Reservoir. Horseshoe Reservoir was emptied on June 15, 2013 and Bartlett Dam releases were reduced to minimum on June 17, 2013. The water order switched back to the Verde system on October 15, 2013. The lake levels for Horseshoe and Bartlett reservoirs are shown below (Figures 3 and 4).

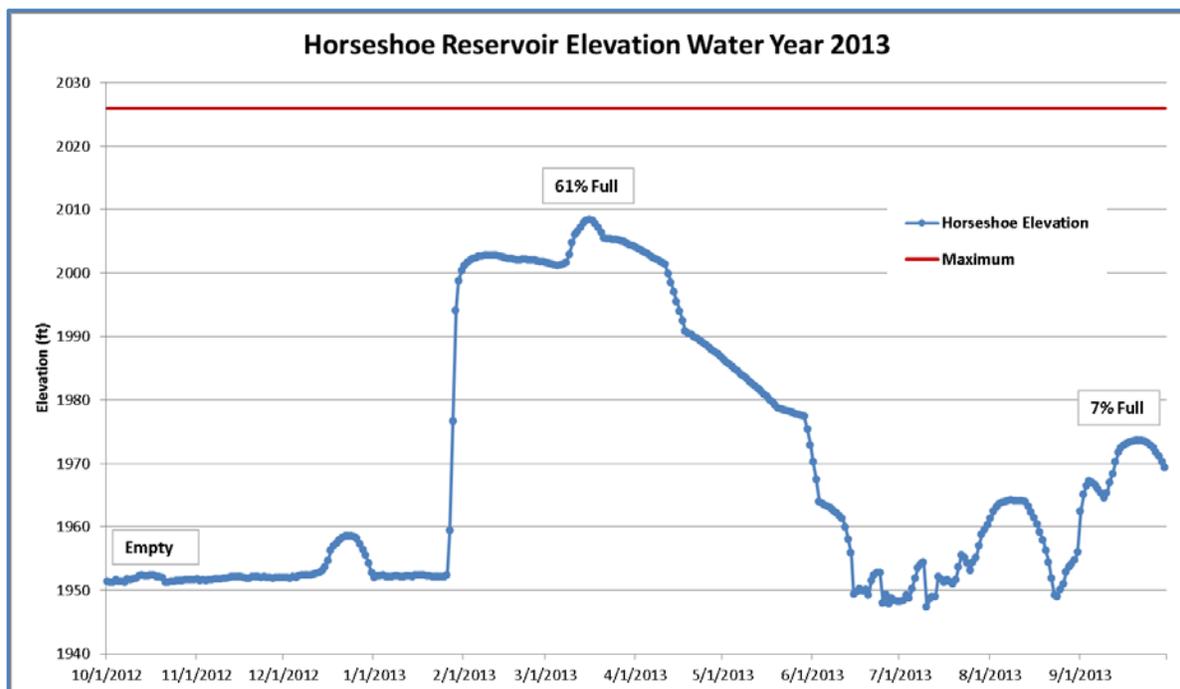


Figure 3: Horseshoe Reservoir Elevation for Water Year 2013

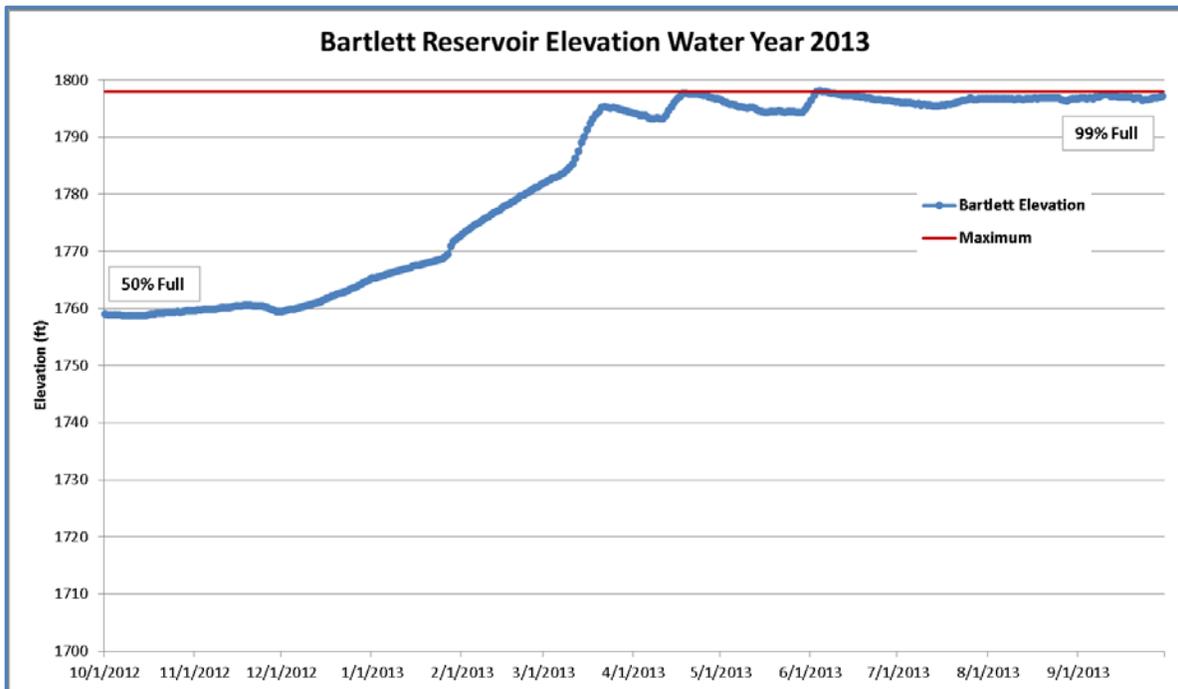


Figure 4: Bartlett Reservoir Elevation for Water Year 2013

b. Flycatcher and Cuckoo Operation Objective

Obligation: SRP will manage water levels at Horseshoe, conditional on other operation goals, to make riparian habitat available earlier in the nesting season and to maintain riparian vegetation at upper end of the reservoir. After two successive years of low water levels due to drought, Horseshoe will be filled ahead of Bartlett, if feasible, to provide water to tall dense vegetation at upper end of Horseshoe.

Action: Horseshoe storage reached a maximum of 61% full (elevation 2009') the last week of March and was held at or above elevation 2000' February through the end of April.

2014 Action: The reservoir spring draw down will occur as usual in 2014. However the reservoir will likely be filled earlier than typical to allow for construction of a new valve on the downstream side of Horseshoe Dam.

c. Covered Aquatic Species Operation Objective

Obligation: SRP will manage water levels at Horseshoe, conditional on other operation goals, to minimize the reproduction, recruitment, and survival of nonnative fish by rapidly drawing down the reservoir and minimizing carry-over storage. In years when the reservoir is held high for flycatchers, this will provide opportunities for razorback sucker reproduction and recruitment.

Action: Horseshoe Reservoir was drawn down as in previous years but reached empty later. This is attributed to near full reservoir conditions in Bartlett limiting water managers ability to evacuate Horseshoe more quickly.

2014 Action: Horseshoe Reservoir will be operated normally as to minimize carry-over storage in the spring.

d. Covered Bird Monitoring

i. Vegetation Monitoring

Obligation: SRP will use vegetation monitoring at Horseshoe to identify trends in the amount and height of tall dense vegetation to assist in the evaluation of whether adaptive management thresholds or ITP limits may be exceeded. Vegetation will be monitored once every three years.

Action: Previously, SRP ran the multi-scaled habitat model using Landsat 5 satellite images. This model was developed using the band wavelength thresholds of the Landsat 5. However, Landsat 5 images are no longer available for time periods after November 2011 when the satellite experienced catastrophic failure. Because of this, SRP ran the multi-scaled habitat model in 2012 using Landsat 7 ETM satellite images which collect the same band wavelength thresholds as Landsat 5. However, Landsat 7 images can contain gaps of missing information in individual scene data due to a scan line corrector malfunction in the satellite that occurred in 2003. Due to these potentially missing data, SRP switched to Landsat 8 in February, 2013. Unfortunately it appears that Landsat 8 has its own issues. The threshold to identify riparian habitat is different from that of Landsat 5, specifically, the “red” and “nIR” band wavelengths. By comparing recent years’ modeled habitat probability outputs at locations with nearly identical vegetative composition to the current modeled output, 2013 results appear somewhat underestimated due to this difference between Landsat 5 and Landsat 8. Currently, SRP’s GIS department is working with the author of the model to redefine parameters associated with the thresholds in the model to deliver the most accurate estimate of habitat.

Model results (Figure 5) from this year estimates that of the 147 acres of potentially suitable flycatcher breeding habitat (GIS model classes 3-5) that occurred in the reservoir in 2013, 0 acres would have been unavailable on May 1, 2013 (Table 1). The average amount of potentially suitable habitat that may have been unavailable at the beginning of the 2009–2013 breeding seasons was 26 acres, which is below the 200 acre average long-term permit threshold.

Table 1. Acres of occupied and predicted flycatcher habitat based on GIS breeding habitat model in Horseshoe Reservoir, 2008–2014

Year	May 1 Reservoir Elevation (feet)	Occupied Habitat (acres)		Predicted Habitat Probability class 3-5 (acres)	
		Occupied Habitat ¹	Occupied Habitat Unavailable May 1	Total within Reservoir	Estimated Habitat Unavailable May 1 ³
2008	-	52	-	95	-
2009	2000	-	0	141	42
2010	2026	-	52	28	87
2011	1981	80	0	82	0
2012	1950	-	0	76	0
2013	1987	-	0 ²	147	0
Annual Avg.	-	-	-	95	32
2014 predicted ⁴					134

¹Flycatcher surveys performed every three years within the reservoir (see Section 3.d.ii).

²The lowest elevation of occupied habitat in 2011 (the most recent year occupancy data available prior to May 1, 2012) was 1985 ft. Water level on May 1, 2012 was 1987 ft. Therefore, no occupied habitat was unavailable (see assumptions outlined in the H-B HCP page 109).

³Estimated amount of habitat unavailable on May 1 is based on the elevation of classes 3-5 of the previous year's model results, the reservoir elevation on May 1, and the assumption that the vegetation is 25 ft. tall. If less than 15 ft. of vegetation was not above water on May 1 the habitat was considered unavailable (see assumptions outlined in the H-B HCP page 109).

⁴Assumes reservoir at full pool on May 1; habitat assumed unavailable if located at elevations $\leq 2015'$ (see assumptions in note #3 above and the H-B HCP page 109).

2014 Action: For 2014 SRP will work with USGS to modify the habitat model to accommodate differences between the previous Landsat 5 data and the new Landsat 8 data. SRP may also compare the results between the pre and post model modifications to determine the degree of underestimation of habitat in the 2013 model results.

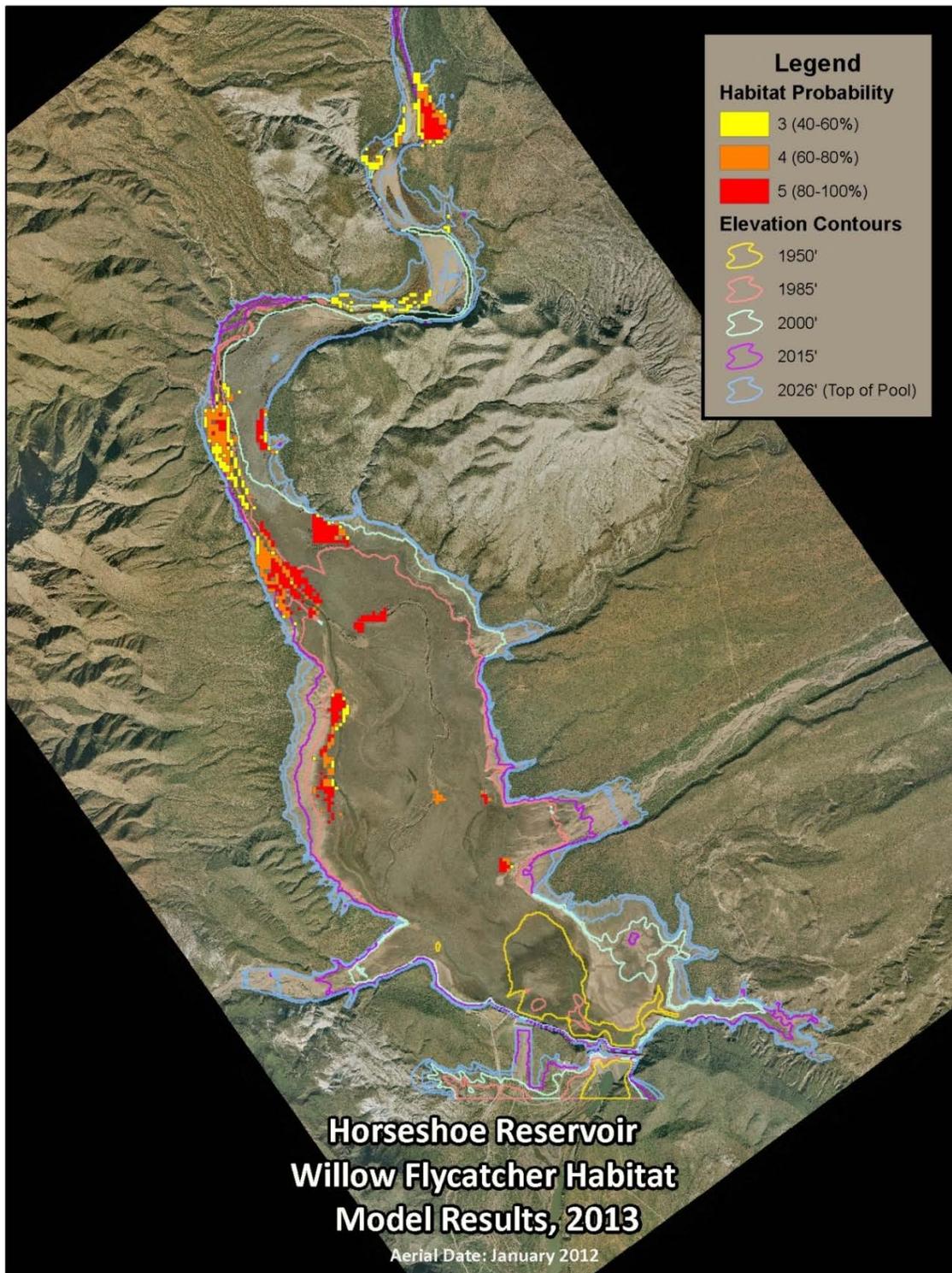


Figure 5. Willow flycatcher potential breeding habitat in Horseshoe Reservoir based on GIS satellite model results using June 2013 imagery. [note: model grid code scale: 3–5 breeding probability based on Hatten and Paradzick (2003); sediment contour interval 1950'≈0% storage; 1985'≈25% storage; 2000'≈50% storage; 2015'≈75% storage; 2025'≈98% storage.]

ii. Flycatcher Monitoring

Obligation: SRP will monitor the flycatcher population to assist in the evaluation of ITP compliance relative to thresholds for adaptive management and the cap on harm of occupied habitat. The method used to determine occupied habitat is explained in Section IV.B.1.B of the H-B HCP. The adaptive management threshold is an annual average of 200 acres of potentially impacted occupied habitat and the cap is 400 acres. Flycatcher surveys will be conducted every three years.

Action: Flycatcher surveys were not conducted at Horseshoe in 2013. LIDAR data collected during the winter of 2012 was used in conjunction with aerial photography to identify potential flycatcher habitat and compare with occupied areas located during the 2011 surveys. The intent of this exercise was to verify habitat model prediction accuracy.

2014 Action: Flycatcher surveys will be conducted at Horseshoe in 2014.

iii. Yellow-billed Cuckoo Monitoring

Obligation: SRP will monitor cuckoos at Horseshoe to identify the long-term trend in the population. The reservoir will be surveyed every three years.

Action: Cuckoo surveys were not conducted at Horseshoe in 2013.

2014 Action: Cuckoo surveys will be conducted at Horseshoe in 2014.

iv. Bald Eagle Monitoring and Emergency Rescue Protocol

Obligation: SRP will develop a coordinated plan with FWS and AGFD to identify when rescue actions would be required and the process to rescue bald eagle, bald eagle eggs, or nestlings; at Horseshoe or Bartlett. The plan will include triggers for winter monitoring at appropriate effort and frequency to determine if a nest has been built in the conservation space of the reservoir and the likelihood that the nest could be impacted by spring runoff. The plan will be completed within one year of permit issuance, and the implementation will begin within two years of ITP issuance.

Action: In 2009, SRP completed the Monitoring and Rescue Plan (see 2009 H-B HCP annual report). Eagles did not nest within the reservoir pool during the 2013 nesting season.

2014 Action: SRP will continue to implement the monitoring and rescue plan in 2014.

e. Covered Aquatic Species Monitoring

Obligation: SRP will monitor covered aquatic species populations and the effectiveness of minimization and mitigation measures. Periodic surveys in Horseshoe and several other locations in the Verde River will be conducted. Native fish composition and age class information will be recorded, and fish will be tagged in Horseshoe to assess movements from the reservoirs. In the first five years of implementation surveys will be focused near Horseshoe Reservoir.

Action: SRP contracted with the AGFD Region 6 fisheries program to complete a survey of the Verde River and with the Colorado Plateau Research Station to conduct northern Mexican gartersnake surveys at the Camp Verde Riparian Preserve. Fish surveys were conducted March 19-20, 2013, in Horseshoe (Appendix A), and July 30 to August 1, 2013, from just below Horseshoe dam downstream to near KA Ranch (Appendix B). Gartersnake surveys were conducted from April–October on the Verde River at Camp Verde (Appendix C)

Summary of Horseshoe Sampling Results

During the 2-day survey, the electrofishing crew sampled 36 sites and shocked and physically captured 697 fish. Eleven fish species were collected during the survey, of which one was native. Goldfish (*Carassius auratus*) was the most common species collected and comprised 63.8% of the fish collected (Figure 6). Common carp (*Cyprinus carpio*) had the second highest frequency at 14.5%, followed by largemouth bass (*Micropterus salmoides*) at 7.7%, red shiner (*Cyprinella lutrensis*) at 4.7%, bluegill (*Lepomis macrochirus*) at 3.9%, and mosquitofish (*Gambusia affinis*) at 2.3%. Smallmouth bass (*Micropterus dolomieu*), green sunfish (*Lepomis cyanellus*), channel catfish (*Ictalurus punctatus*), yellow bullhead (*Ameiurus natalis*), and razorback sucker (*Xyrachen texanus*); each comprised less than 2% of the frequency by species.

Length frequency analysis was conducted for all measured fish. Multiple age classes of common carp and largemouth bass were evident indicating reproduction and recruitment in these species. The majority of the largemouth bass were between 240 and 340 mm total length while the common carp collected were larger (>400 mm) individuals. All bluegill collected were less than 150 mm and were likely age 1 and age 2 fish. Goldfish length frequencies showed two distinct age classes likely represented by age 1 and age 2 fish.

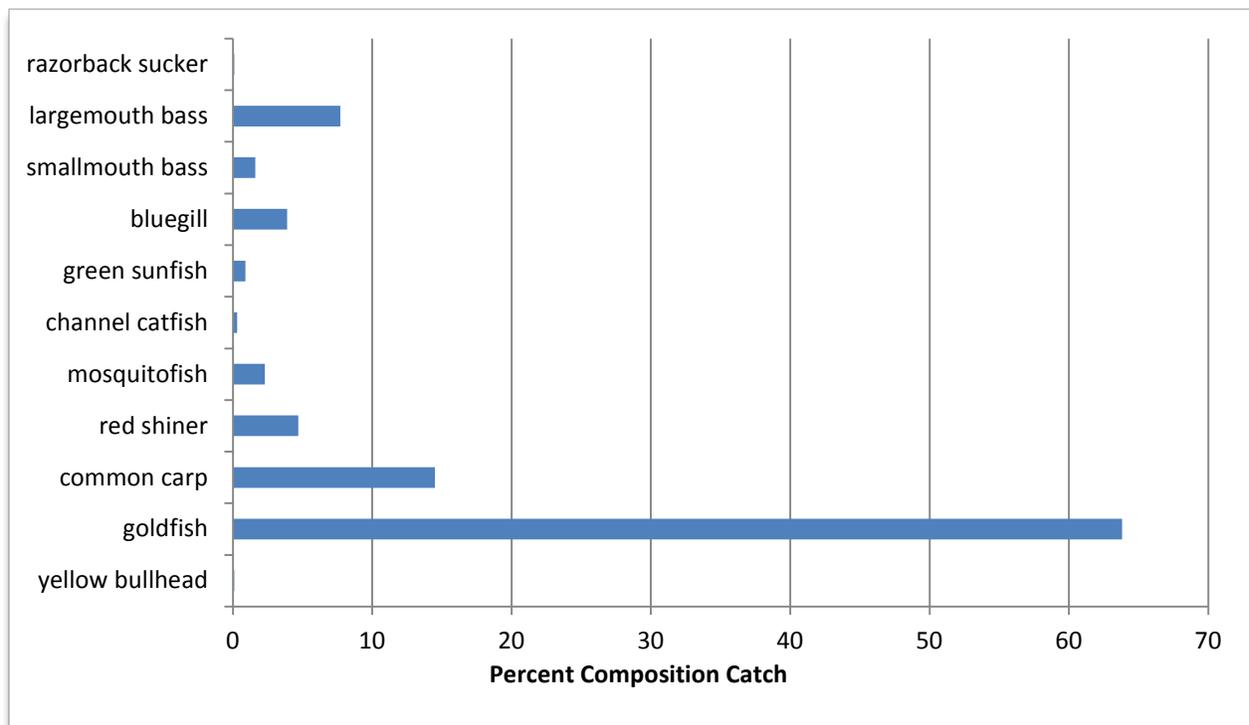


Figure 6. Composition of fish species captured in 2013 by AGFD using electrofishing equipment in the Verde River March 19–20 in Horseshoe. Values suggest relative fish species frequency.

Data were compared to past surveys that were conducted 2009 and 2011. Catch per unit effort (CPUE) for all nonnative species combined in 2013 was 76.55, between the results from 2009 (519.99) and 2011 (18.68). The CPUE for the 2013 survey was substantially higher than the 2011 survey. This is most likely due to the time of day the surveys were conducted and the gear types used. In 2011 the boat ramp was out of the water so electrofishing canoes were used to sample the shoreline during daylight hours. In 2013 the reservoir was sampled with

electrofishing boats after dark. Although the reservoir was higher during 2013, survey catch rates were more than four-fold those in 2011. In 2009 catch rates were nearly seven-fold what they were in 2013. This is most likely because the 2009 survey was conducted at minimum pool. The 2009 survey utilized electrofishing canoes but fish were concentrated and maximum depth was less than 2 meters. This suggests that if the primary objective is to tag the most fish possible then sampling at minimum pool may be the most efficient.

A single razorback sucker was found during surveys, though no other native fish (such as Colorado pike minnow and roundtail chub) were collected. Although thousands of non-native fish have been tagged in Horseshoe during previous surveys, none were observed during the 2013 survey.

Summary of Verde River–Below Horseshoe Reservoir Sampling:

There were a total of 201 fish were collected using gill nets comprising eight species, including yellow bullhead (comprised 0.5% of the fish collected), goldfish (19.9%), common carp (29.9%), threadfin shad (*Dorosoma petenense*) (8.0%), channel catfish (13.4%), bluegill (1.0%), largemouth bass (12.9%), and flathead catfish (*Pylodictis olivaris*) (14.4%).

An additional 14 fish were collected comprising five species using two seine hauls during the survey. The only species collected in the two seine hauls that was not collected in gill nets was red shiner. The two seine hauls were both roughly 45 m long and collected six threadfin shad, four bluegill, two largemouth bass, one red shiner, and one common carp.

Multiple size classes of common carp and goldfish were noted indicating that they are reproducing in the system. Although we collected 173 nonnative fish that were large enough to have been tagged/marked during the March 19-20, 2013, tagging effort in Horseshoe Reservoir, no tagged/marked fish were collected during this survey. To date, no tagged/marked fish have been collected during monitoring efforts outside of Horseshoe Reservoir in recent years, although more than a thousand fish have been tagged/marked within the reservoir since 2009. This suggests that fish are not moving out of Horseshoe Reservoir as it drains, at least not in large numbers. Many fish likely die when the reservoir annually reaches minimum pool and the remainder persists within the minimum pool. Future survey sampling effort may want to consider other methods (e.g. radio telemetry) to definitively determine whether fish do emigrate from Horseshoe Reservoir as it drains to minimum pool.

Summary of Herpetological Monitoring

Northern Mexican Gartersnake Surveys were conducted at the Camp Verde Riparian Preserve from April through October 2013. Survey efforts included both minnow traps and visual encounter surveys; 64 new capture northern Mexican gartersnake individuals and 38 recaptures (initially captured in 2012 and 2013) were detected. The greatest number of captures occurred during the May 13-19 trapping session where 28 new individuals and 22 recaptures were encountered (Table 2). A total of 90 individual Mexican gartersnakes have been documented during the 2012 and 2013 survey season, placing this population within the top three sites in Arizona and the United States for numbers of confirmed individuals. Northern Mexican gartersnake detections (with one exception along the mainstem river) were associated with backwater ponds, pools, and channels created by beaver activity and previous flood events. These locations featured dense emergent and riparian vegetation including cattail, bulrush, and sedge species, and riparian obligate trees including willow and cottonwood.

In addition to the northern Mexican gartersnakes numerous reptile, amphibian, and fish species were also documented during surveys.

- 3 Sonora mud turtle (*Kinosternon sonoriense*);
- 4 adult and juvenile Woodhouse's toad (*Bufo woodhousii*);
- 2,630 American bullfrog (183 adults and juveniles and 2,447 tadpoles);
- 938 unidentified tadpoles (either Woodhouse's toad or American bullfrog);
- 4,032 mosquitofish (*Gambusia affinis*);
- 389 green sunfish (*Lepomis cyanellus*);
- 3 bluegill (*Lepomis macrochirus*);
- 415 largemouth bass (*Micropterus salmoides*);
- 91 red shiner (*Cyprinella lutrensis*);
- 1 black bullhead (*Ameiurus melas*);
- 3 yellow bullhead (*Ameiurus natalis*);
- 1 common carp (*Cyprinus carpio*);
- and 168 northern crayfish (*Orconectes virilis*).
-

Table 2. Survey effort and gartersnakes detected by minnow traps ("trap") and visual encounter surveys ("VES") during surveys for Mexican gartersnakes in the Salt River Project Camp Verde Riparian Preserve, Arizona, 2013.

Dates Surveyed	Survey Method	Survey-hours	Trap-hours	Gartersnakes detected
04/26-04/30/13	trap	39.7	6625.51	2 new
	VES	6	-	1 new (deceased remains)
05/13-05/19/13	trap	73.6	10642	28 new 22 recaptures
	VES	1	-	none
06/27, 06/29/13	VES	11	-	none
07/15-07/21/13	trap	68.16	8640	10 new 4 recaptures
	VES	6.25	-	none
07/24-07/30/13	trap	28.83	8403	6 new (1 deceased remains) 4 recaptures
09/26-10/04/13	trap	22.7	9431.65	12 new (2 incidental near traps) 8 recaptures
10/19-10/22/13	trap	3.5	1096.2	5 new

Researchers have also fitted eight gartersnakes (seven females, one male) with radio transmitters. Two different sized transmitters have been deployed, three have a battery life of one year and five have a battery life of six weeks. The larger transmitters are being used to determine habitat selection and individual movements throughout the year, while the smaller transmitters are being used to document hibernacula location and site fidelity, and communal denning behavior.

2014 Action: SRP is discussing future fish monitoring efforts with AGFD. At this time it is uncertain what fisheries evaluations will be conducted in 2014.

4. Status of Mitigation Property Acquisitions

Obligation: SRP must acquire and manage in perpetuity 200 acres of riparian habitat by fee title or conservation easements. Within one year of the permit issuance date, at least 150 acres of mitigation will be in place, and within ten years an additional 50 acres will be protected.

Action: On August 11, 2009 SRP and Freeport McMoRan executed a conservation agreement to secure the protection of the 150 acre preserve near Fort Thomas (SRPCE4). No additional action is needed until 2023 when the property will be purchased in fee.

SRP completed the purchase of the 55 acre Indian Springs parcel in December of 2011. The Fort Thomas baseline inventory report and management plans were updated to include both the 150 SRPCE4 parcel and the 55 acre Indian Springs parcel.

2014 Action: SRP has developed a fire management plan for the entire Fort Thomas Preserve and it is anticipated to be finalized after receiving comments from the Bureau of Reclamation.

5. Mitigation Property Monitoring and Management

a. Fort Thomas H-B Preserve (SRPCE4 and SRP2)

i. Flycatcher and Cuckoo Monitoring

Obligation: SRP will conduct flycatcher and cuckoo surveys the first spring and summer following land acquisition. If flycatchers are found, SRP will conduct a second year of surveys to establish a baseline. Once baseline surveys are complete, SRP will survey for flycatchers and cuckoos every other year on average but not less than every third year.

Action: No flycatcher or cuckoo surveys were conducted on the Fort Thomas H-B Preserve in 2013 (Table 3).

Table 3. Southwestern willow flycatcher and yellow-billed cuckoo survey results for the Fort Thomas H-B Preserve, 2008–2013.

Year	Willow flycatcher				Yellow-billed cuckoo	
	Resident Adults	Territories	Pairs	Nests	Detections	Incidental
2008	10	6	4	0	2	0
2009	14	8	6	5	0	0
2010	No Surveys					
2011	No Surveys					
2012	12	10	9	4	2	1
2013	No Surveys					

2014 Action: Flycatcher and cuckoo surveys will be conducted at Fort Thomas Preserve in 2014.

ii. Vegetation and Habitat Monitoring

Obligation: SRP will conduct field observations assessment of habitat type, structure, and density of riparian and other vegetation. On-the-ground photo documentation from fixed points will be collected during the bird surveys.

Action: Patrols and site visits to the property indicated that no significant vegetation changes occurred in 2013.

2014 Action: Photo points will be revisited in conjunction with the 2014 bird surveys. Photo points will be established in SRPCE4.

iii. Management Obligations

Obligation: SRP's primary goal for management of these properties is to provide ecological and conservation benefits to the flycatcher and cuckoo. Management activities are focused primarily on minimizing or eliminating identified threats to riparian habitat, such as wildfire, groundwater pumping, surface water depletion, trespass livestock grazing, cowbird parasitism and vandalism. Actions to enhance the quality of habitat on a property or reverse past damage may also be conducted.

General management activities required for each property are listed below:

1. SRP will identify a manager for all acquired properties.
2. A management plan will be developed for each property within two years of acquisition in coordination with FWS and will be updated annually.
3. Management activities identified in the management plan will be implemented.
4. Cowbird management will occur on properties that are agreed to by SRP and FWS during the annual H-B HCP meeting.
5. Conservation easements shall be placed on all appropriate mitigation lands and will be held by an agency or organization acceptable to FWS.

Actions: SRP completed the following major management actions on the Fort Thomas H-B Preserve in 2013:

- The Nature Conservancy (TNC) conducted patrols (which may include inspection and maintenance of access and signage, work and coordination with adjacent landowners and local law enforcement officials, and assistance with biological monitoring).
- SRP completed a wildfire management plan for the Fort Thomas Preserve. This plan is being reviewed by the Bureau of Reclamation.
- SRP contractors continue to monitor the test plots that were established following the 2011 fires at the Fort Thomas Preserve.

Tamarisk Treatment Test Plot Monitoring.

In the winter of 2012, final applications of herbicide were applied to the test plots. All plots were monitored for re-sprout through 2013. Of the three treatments used (cut-stump, cut-stub, and basal bark), the cut-stub method seems to be the most effective. Despite several retreatments, the cut-stump individuals continue to re-sprout vigorously. The basal bark individuals have all either re-leafed from older growth or re-sprouted from the base, or both. While the cut-stub individuals show some re-sprout, on the whole, the treatment appears to have killed the most individual plants.

Native Planting Test Plot Monitoring.

Seeded areas are seeing mixed results. Some areas have experienced little if any success from the seed mix, while other areas (planted on the same schedule) are becoming crowded with salt bush (*Atriplex* spp.). Salt bush species has shown the greatest success of all seed mix species.

Fort Thomas Post-Fire Restoration.

SRP staff initiated a review of the post-fire treatments that have occurred to date at the Fort Thomas Preserve following the February 2011 fires. This report documents the tamarisk treatment activities and native plantings at the Fort Thomas Preserve from February 2011 to February 2013. Included in the report are detailed descriptions of the tamarisk treatment actions and the subsequent results, as well as the location and species lists for all native plant plantings and the success of those plantings. Also included is a lessons learned section detailing what has worked and what has not worked in regards to these post fire activities, as well as a recommendations section for future restoration activities.

Trespass Incidents.

While conducting a site visit to document flycatchers at the north end of the Preserve, adjacent to the burn area, a fishing-hole was discovered along the River's edge just upstream of the burn. A substantial amount of work had been done clearing a trail through the tamarisk, including whole trees cut down and saw markings on uncut trunks. The camp has been

scattered, trash hauled out, and “No Trespass” signs placed at the camp and at the beginning of the trail. This site will be monitored for future trespass.

Clay Fire.

On Friday, March 29, 2013, a human caused fire started north of the Fort Thomas Preserve properties but came south burning across much of SRPCE4 (the northernmost conservation easement property associated with the H-B HCP) and into the northern third of SRPCE1 (Roosevelt HCP conservation easement). This fire eventually burned approximately 450 acres of mostly salt cedar monoculture but also including some stands of saltbush, cottonwood, and Goodding’s and coyote willow (Figure 7). Fort Thomas Fire Department and Bureau of Land Management Fire were on-scene within an hour of ignition and worked through the weekend at attaining full suppression.

Substantial strands of native vegetation were left unburned, and some patches of coyote willow that were singed by nearby fire were seen to be re-sprouting within two weeks. Additionally, opportunistic species such as *Datura*, *Hymenoclea* and *Baccharis* were also beginning to re-sprout after only two weeks.

In early June, two bags of seed mix (80lbs total), leftover from the 2011 fire restoration, were applied to an area of approximately four acres along the southwestern edge of the 2013 Clay Fire. One bag was spread using a hand seeder, the other using the ATV-pulled unit. The whole area seeded was raked using a 6ft chain-harrows pulled by the ATV.

The area that burned included habitat that had been occupied by both flycatchers and cuckoos in 2012. Habitat for approximately six flycatcher territories and two cuckoo detection locations were lost in the fire. The area just to the south of the fire (Figure 8) was visited mid-June to document flycatcher activity adjacent to the burn (see *Bird Surveys* above). Burned tamarisk re-growth at the time of the visit was approximately 4 feet (3 ½ months post fire).



Figure 7. Clay Fire looking downstream toward the northwest across SRPCE1 and SRPCE4. Photograph take May 1, 2013.



Figure 8. Clay Fire looking at the southeastern extent of the burn area adjacent to the upstream occupied habitat. Photograph take May 1, 2013.

2014 Actions: SRP plans to conduct the following management actions in 2014 on the Fort Thomas Preserve:

- Finalize the fire management plan.
- Continue to monitor both the tamarisk and native planting test plots; documenting the results of both activities.
- Finalize the Fort Thomas Post-Fire Restoration report.
- Continue to coordinate with BLM regarding fencing of the riparian area.
- Continue on-the-ground management activities in coordination with the Roosevelt HCP project manager.
- Continue to actively participate in the GWP and work closely with the Stillwater Sciences and Walton Family Foundation staff on potential restoration projects.

b. Special Water Supply Protection Projects

Obligation: SRP will use its best efforts to protect future water supplies for mitigation lands.

Action: SRP provided funding to the U.S. Geological Survey (USGS) to conduct field work related to a 2-year Ecoflows project, which is a partnership among the USGS (Arizona and Utah offices), AZ Department of Water Resources, and the TNC, to investigate the connection between stream flow in the Verde River and habitat along the riparian corridor. The USGS is currently completing the report of the two-year Phase 1 project.

The original agreement between the USGS and the TNC did not include funds to support additional field work in Phase 1. The additional support from SRP provided crucial support for field efforts, macroinvertebrate identification, data analysis, and geospatial interpretation of habitat characteristics. The results obtained with the SRP funding are included in the Phase 1 report which is in draft form and being peer reviewed.

In addition to completing the first phase, USGS installed a Continuous Slope Area (CSA) gage below the low flow SRP gage at Campbell Ranch (AGFD issued a permit for the installation). The gage installation was supported by the USGS WaterSMART program. During the first

phase of the Ecoflows project, a biotic sampling site was established at Campbell Ranch. The CSA gage, which consists of three recording stage sensors from which discharge can be computed, is intended to complement the SRP gage by allowing for the estimation of discharges higher than the rating curve at the low-flow gage. The combined low-flow and CSA discharges should provide complete discharge records at Campbell Ranch.

2014 Action: After completion of the final Ecoflows Phase 1 report, the USGS will begin planning Phase 2.

6. Aquatic Species Mitigation

The overall goal of the minimization and mitigation measures for covered aquatic species is to offset the direct impacts caused from stranding and passage through the outlet works, and the indirect impacts (predation and competition) caused by the increase of nonnative fish produced in the reservoirs. Minimization and mitigation obligations under the H-B HCP include: rapid draw down of Horseshoe Reservoir; stocking adult and sub-adult razorback sucker in Horseshoe or elsewhere; installation of a fish barrier on Lime Creek; funding and supporting improvements to Bubbling Ponds Hatchery; stocking covered native fish in the Verde watershed; and watershed management activities that conserve in-stream flow, species, and habitats. The following implementation actions were taken:

a. Rapid Draw Down of Horseshoe Reservoir

Obligation: See Section 3.c.

Action: See Section 3.c.

2014 Action: See Section 3.c.

b. Stocking of Razorback Sucker at Horseshoe and Other Covered Species in Verde River.

Obligation: SRP will provide support for AGFD to stock razorback sucker during Horseshoe fills when conditions may be favorable. Other river segments may be stocked with razorback sucker upon mutual agreement among AGFD, FWS, and SRP. SRP will provide support to increase stocking of other covered native fish species in the Verde watershed.

2013 Action: SRP continued funding AGFD O&M and stocking actions at BPH under the collection agreement. As of March 31, 2013, 11,898 native fish were stocked into the Verde River watershed (Table 4).

Table 4. Native fish stocked by AGFD in support of H-B HCP through March 31, 2013.

Stocking Date	Species	Number stocked	Pounds stocked	Location
10/12/2011	Gila Topminnow	2,981	5	Fossil Creek
1/10/2012	Roundtail chub	150	9	Roundtree Creek
1/10/2012	Roundtail chub	851	1,165	Verde–Childs
2/3/2012	Roundtail chub	3,808	98	Verde–Perkinsville
2/3/2012	Roundtail chub	3,808	98	Verde–Beasley Flat
2/15/2012	Roundtail chub	300	0.74	Verde–Roundtree Creek
4/10/2012	Razorback sucker	450	833	Verde–Beasley Flat
4/18/2012	Razorback sucker	902	1,074	Verde–Beasley Flat
4/30/12	Roundtail Chub	995	25	Wickenburg Ranch
10/17/12	Spikedace	3,417	68	Fossil Creek
12/11/12	Roundtail Chub	1,398	34.5	Oak Creek–Grasshopper Point
Total		19,060	2,296.5	

2014 Action: Coordinate a meeting among AGFD, FWS, and SRP in the spring of 2014 to discuss the status of implementation, changes to the species priorities or locations, and plans for future culture and stocking effort. Continue to fund BPH O&M and stocking activities. Will coordinate to develop a culture and stocking plan to be implemented over 2014–2016.

c. Bubbling Ponds Hatchery Improvements

Obligation: SRP will provide \$500,000 in funding or in-kind support for planning, design, engineering, and fund raising to improve and expand AGFD’s BPH.

Action: In 2012, SRP met AGFD and Reclamation to discuss the BPH remodel plan and the lack of funds to implement the plan as written. However, funds currently available from Reclamation and SRP could be utilized to leverage additional Reclamation funds to upgrade and repair facility components crucial to facilitating existing programs. AGFD will work to identify crucial infrastructure needs and prioritize repair and replacement work in the coming years. No further developments have taken place since the 2012 meeting.

2014 Actions: Continue to support AGFD BPH upgrade plan development and coordinate its planning and implementation.

d. Installation of a Fish Barrier in Lime Creek

Obligation: SRP will construct and maintain a fish barrier in Lime Creek to benefit resident, covered aquatic species such as Gila topminnow, longfin dace, and lowland leopard frogs.

Action: The barrier was completed on November 4, 2010. The construction of the barrier was described in detail in the 2010 H-B HCP annual report. SRP visited and inspected the barrier during a May 2012 site visit. The barrier was structurally sound and functional, and, as anticipated, sediment had filled in most of the pool above the barrier. There was no inspection conducted in 2013.

2014 Actions: SRP will monitor barrier condition and conduct maintenance, as necessary. SRP, in coordination with AGFD and USFS, may also monitor the fish populations in Lime Creek.

e. Watershed Management Efforts

Obligation: SRP will continue, and expand where feasible; its substantial watershed management efforts to maintain and/or improve stream flows, which benefit all main-stem species.

Actions: SRP took the following actions in 2013 to protect watershed in-stream flow:

- Public outreach and education
- Funding research and monitoring
- Administrative and legal efforts to protect in-stream flows

A detailed list of Watershed Management and Protection projects that occurred in 2013 is provided in Table 5.

2014 Action: SRP will continue supporting watershed protection efforts in 2014.

Table 5. SRP watershed protection efforts accomplished in 2013.						
Project Name	Date Initiated	Date Completed	SRP Contribution	Description and Comments	In-kind	Cash
Public Presentations	Ongoing	Ongoing	NA	9 public presentations to community groups and various agencies (e.g., Verde Watershed Association, Project CENTRL, 9 th Grade Class Northpoint Academy in Prescott, Flagstaff Arts and Leadership Academy, Mesa Academy for Advanced Studies, and others).	x	
Agreement in Principle re: Big Chino Groundwater withdrawals	Ongoing	Ongoing	\$225,000	Executed Comprehensive Agreement #1 between SRP, the City of Prescott, and the Town of Prescott Valley to implement monitoring and modeling of groundwater conditions in the Big Chino sub-basin to ensure appropriate protections against impacts to the Upper Verde River. Includes long-term funding commitment.		x
Legal efforts to curtail illegal groundwater pumping and surface water diversions–Verde Valley	Ongoing	Ongoing	NA	SRP continued its litigation against several groundwater pumpers in the Verde Valley who appear to be illegally diverting surface water.	x	
NAU Watershed Research and Education program (WREP)	May 2013	May 2014	\$50,000	Program and Project specific funding for NAU WREP program. Three research projects funded (Predicting groundwater yield following landscape-scale forest restoration along the Mogollon Rim, Prioritization of spring-remediation projects through statistical analysis of spring assessments in the Coconino & Kaibab National Forests, Endocrine Disruption Compounds in the Verde River: Androgenic or Estrogenic?).		x

Table 5. SRP watershed protection efforts accomplished in 2013.						
Project Name	Date Initiated	Date Completed	SRP Contribution	Description and Comments	In-kind	Cash
USGS/SRP cost share of stream gage maintenance	Jan 2013	Dec 2013	~\$130,000	SRP's contribution to the USGS Joint Funding Agreement for the operation and maintenance of stream and reservoir gages in the Verde watershed (amount does not include reservoir gage operations).		x
WatershedMonitor.com	Sep 2007	Ongoing	NA	Maintain the website (www.watershedmonitor.com) which displays real time data for river flows and precipitation across the Salt and Verde Watersheds.	x	
Verde River Runoff	Mar 2013	Mar 2013	\$2,000	Corporate sponsor of the Verde River Runoff.		x
Low Flow gages (Black Bridge, Verde Falls, Campbell Ranch, Bubbling Ponds Hatchery, Sterling Springs)	2005+	Ongoing	\$57,477	2013 O&M and telemetry support for gages.	x	
Installation of Low Flow gage East Verde @ Crackerjack	March 2012	ongoing	\$35,000	Capital cost and initial O&M for installation of gage.		x
Verde River Days	Sep 2013	Sep 2013	\$500	SRP sponsorship for event. SRP was also an Exhibitor.		x
Verde River Ditch Days	Sep 2013	Sep 2013	\$200	2013 event was cancelled due to high river flows. Donation will roll to 2014.		x
Yavapai College Foundation	Nov 2013	Nov 2013	\$5,000	SRP Donation/Table sponsorship for event. Theme re: Working Together for Sustainable Communities and Healthy Forests.		x
The Verde Valley Regional Economic Organization (VVREO)	Nov 2013	Nov 2013	\$1,000	Membership to VVREO and corporate sponsorship for 'speakers series' featuring Jack Schultz and Craig Lindvahl.	x	x
Arizona Water Story	Jan 2010	Ongoing	In-Kind	SRP distributes this water education video as part of the Arizona Water Story to assist 4 th grade teachers throughout the state in teaching water science and Arizona history to their students.	x	

Table 5. SRP watershed protection efforts accomplished in 2013.						
Project Name	Date Initiated	Date Completed	SRP Contribution	Description and Comments	In-kind	Cash
Water Education Grants	Oct 2007	Ongoing	\$4,750	SRP collaborated with the towns of Prescott and Prescott Valley as well as the Yavapai County Water Advisory Committee and Arizona Department of Water Resources to provide Water Education Grants to outstanding water education programs taking place in Yavapai County.		x
Water Chemistry/Quality Kits	Ongoing	Ongoing	In-Kind	Water Chemistry/Quality kit building and instruction to teachers through Sci4Kids EIG.	x	
Yavapai County Cooperative Extension Office /Project WET	Aug 2008	Ongoing	\$15,000	SRP supported Edessa Carr with programming related to water education in Yavapai County. She has conducted numerous trainings on the Arizona Conserve Water curriculum guide, and worked with teachers from Prescott, Prescott Valley, Chino Valley, and Verde Valley towns.		x
Verde Valley Youth Outreach Committee	Aug 2011	Ongoing	In-Kind leadership support	SRP serves on this committee to share and leverage partnerships in the Verde Valley related to youth education. Other partners on the committee include the parks, forest service, AZ Project WET, and V-Bar-V.	x	
Four Forest Restoration Initiative and Research Study Agreement with NAU/Ecological Restoration Institute	Jan 2012	Ongoing	\$120,000	SRP is supporting landscape level efforts to restore ponderosa pine forests, which includes the Salt and Verde watersheds to allow for increased ecologic function and decrease risk of catastrophic wildfire. We are also partnering with NAU to evaluate hydrologic effects of various forest treatment types. This study includes the design of a Paired Watershed Study that will evaluate impacts of forest restoration on variables such as run-off, groundwater infiltration, sedimentation, soil moisture, etc.	x	x

Table 5. SRP watershed protection efforts accomplished in 2013.						
Project Name	Date Initiated	Date Completed	SRP Contribution	Description and Comments	In-kind	Cash
Yellow Belly Ponderosa Project	Aug 2012	Current	\$12,000 and In Kind Planning, Including SRP Sponsored Website	The Yellow Belly Ponderosa outreach program combines culture, arts and science to teach 4 th and 5 th graders (and others) about forest health and restoration, stewardship of natural resources, the value of science, wildfire mitigation and safety, and flash flood safety. www.srpnet.com/yellowbelly	x	x
Restoration Investment Strategies for Arizona's Forests and Watersheds Conference	April 2013	October 3 and 4, 2013	Roughly \$40,000 and In Kind Planning, AV, Printed Materials, etc.	This conference will highlight the need for building forest restoration funding mechanisms in Arizona; engaging business, local decision-makers, state legislators, land managers, federal representatives and forest specialists. www.srpnet.com/forest	x	x

7. Funding Methods and Assurances for HCP Implementation

Obligation: No later than five years after the Permit is issued, SRP shall insure that permanent funding is available to meet continuing obligations under the H-B HCP.

Action: Completed.

On March 24, 2009, SRP provided a letter to FWS indicating that we were proposing to establish an irrevocable trust to fund the H-B HCP. On November 2, 2009, the SRP Board approved an amendment to the Roosevelt Lake HCP trust, which allows for the creation and funding of a subaccount to meet the obligation of the H-B HCP. The subaccounts allow for each HCP trust fund to be managed (and reported) independently under a larger umbrella trust agreement. The H-B HCP subaccount was funded in January 2011 with approximately \$6.0M to support the estimated \$300,000 on average annual expenditures over the life of the permit and *in perpetuity* costs for some of the mitigation obligations.

8. HCP Implementation, Survey, and Monitoring 10-year Schedule

Obligation	Completed /Ongoing	Year									
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017+
Horseshoe Reservoir											
Flycatcher and Cuckoo Reservoir Ops	Ongoing	RD ¹	RD	RD	RD	RD	Hold ²	X	X	X	X
Aquatic Species Reservoir Ops	Ongoing	RD	RD	RD	RD	RD	Hold	X	X	X	X
Vegetation Monitoring	Ongoing	X	X	X			X	X			X
Flycatcher and Cuckoo Surveys	Ongoing	X			X			X			X
Bald Eagle Monitoring and Rescue Plan	Completed	X	X								
Bald Eagle Monitoring	Ongoing			X	X	X	X	X	X	X	X
Fish Surveys:	Ongoing		X	X	X	X	X	X	X	X	X
Horseshoe			X	X	X ⁴	SRP ⁵	X		X		X
Verde (upstream Horseshoe)				X	X	X	-	X	?	X	?
Verde (downstream Bartlett)							-	X	?	?	?
Lime Creek		X	X	X	X	X				X	
Frog and Garter Snake Survey	Ongoing					X	X				X
Horseshoe/Verde River Aquatic Species Mitigation											
Bubbling Ponds Hatchery (BPH) Improvements		X	X	X	X	X	X	X			
BPH O & M	Ongoing	-	X	X	X	X	X	X	X	X	X
Stocking RBS & other covered native fish	Ongoing	-	-	X	X	X	X	X	X	X	X
Lime Creek Barrier Construction	Completed	X	X	X							
Watershed Protection Projects	Ongoing	X	X	X	X	X	X	X	X	X	X

Obligation	Completed /Ongoing	Year									
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017+
Fort Thomas Mitigation Property (150 acres)											
Execute Conservation Easement	Completed	X	X								
Management	Ongoing		X	X	X	X	X	X	X	X	X
Purchase											2023-
Flycatcher and cuckoo monitoring ³	Ongoing	X	X			X		X			X
Habitat Monitoring	Ongoing	X	X			X		X			X
Indian Springs Ranch–Fort Thomas Preserve (55 acres)											
Identify suitable property		X	X	X	X						
Secure protection and manage						X	X	X	X	X	X
Special water supply protection projects	Ongoing	X	X	X	X	X	X	X	X	X	X

¹Rapid drawdown and minimize pool

²Hold reservoir high if two successive years of low storage.

³Monitoring frequency dependent upon management needs and cowbird parasitism rate.

⁴Sampling for tagged fish also conducted downstream of Horseshoe dam

⁵SRP will, as feasible, investigate fish stranding in Horseshoe during and after rapid drawdown.

9. Literature Cited

Fish and Wildlife Service. 2008. Final environmental impact statement for the incidental take permit for operations of Horseshoe and Bartlett Reservoirs. March 2008. Arizona Ecological Services Office, Phoenix, Arizona.

Hatten, J. R. and C. E. Paradzick. 2003. A multiscaled model of southwestern willow flycatcher breeding habitat. *Journal of Wildlife Management* 67(4): 774-778.

Salt River Project. 2008. Habitat Conservation Plan Horseshoe and Bartlett Reservoirs. Submitted to the U.S. Fish and Wildlife Service Pursuant to Section 10(A)(1)(B) of the Endangered Species Act. Salt River Project, Tempe Arizona.

APPENDIX A

Horseshoe Reservoir Survey
March 19-20, 2013
Arizona Game and Fish Department

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Horseshoe Reservoir Survey

March 19-20, 2013



Prepared by: Curt Gill



Arizona Game & Fish Department
7200 E. University Dr.
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Background

On March 19-20, 2013 Arizona Game & Fish Department conducted an electrofishing survey within the Horseshoe Reservoir. Arizona Game and Fish Department personnel consisted of Curtis Gill, Jake Jaeger, Lorraine Avenetti, Grant Pearce, Diana Rogers, Bill Stewart, Aaron Bunch, and John Dixon. Additional help was received from Marc Wicke (SRP), Shea Meyer (SRP), and Kent Mosher (volunteer). The objective of this survey was to estimate species composition and age-class structure of fishes in Horseshoe Reservoir and mark nonnative fish within the reservoir. Horseshoe Lake is a reservoir located in the Tonto National Forest and is formed by the Horseshoe Dam on the Verde River in Central Arizona. Horseshoe Lake is the first of the Salt River Project lakes to be fully utilized as water demands dictate and as a result, it can be virtually dry for long periods of time (Figure 1). Over the last five years, the Arizona Game & Fish Department has been intensively tagging and monitoring individual fish within Horseshoe Reservoir and the lower Verde River. This effort was conducted in the hope of recapturing these specific fish and to tag additional fish to determine the movements of these fish during extremely low water levels. To date, no tagged fish have been recaptured.

Methods

Two electrofishing boats were used to conduct the survey. The Region VI boat delivered electricity from an 8K watt water cooled generator through a Smith-Root model VVP-15-B and the Research boat delivered electricity from a 5K watt generator through a Smith-Root model VVP-15-B. Both vessels were outfitted with two adjustable anode arrays mounted on booms and their aluminum hull's served as the main cathode. Both electrofishing boats were maneuvered with a bow-mounted trolling motor while shocking. Both boats delivered electricity at a duty cycle of 40% and a frequency of 60Hz. Output for both boats ranged from five to nine amps. All electrofishing sites were sampled beginning 30 minutes past sunset and were sampled in a counterclockwise direction for 15 minutes (900 seconds). In total, there were 36 electrofishing sites completed within the two day survey (Figure 2). The east side of the reservoir was sampled in March 19 and the west side was sampled on March 20. All sampling methods were conducted based on the Arizona Game and Fish standardized sampling protocol.

All captured fish were identified to species, measured to the nearest millimeter, and weighed to the nearest gram. The exceptions were common carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*) which were only measured and red shiner (*Cyprinella lutrensis*) and mosquitofish (*Gambusia affinis*) which were only counted. All nonnative fish greater than 150 mm in total length were marked by a floy tagged and/or a clip of the anal (common carp) or dorsal spine (all other nonnatives).

Results

In Horseshoe Lake, there were 10 species of nonnative fishes collected (Table 1): common carp, goldfish, red shiner, mosquitofish, largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), channel catfish (*Ictalurus punctatus*), and yellow bullhead (*Ameiurus natalis*). The only native fish species collected was razorback sucker (*Xyrachen texanus*). The one razorback sucker was

collected at site 3E at the northeast end of the reservoir. A total of 696 nonnative fish were collected, with the vast majority of them being goldfish (63.8%), common carp (14.5%), and largemouth bass (7.7%). The other species combined to make up the remaining 14% of fish collected. Of these, a total of 293 fish greater than 150mm were tagged with a Floy tag and 417 were given a distinct mark of either an anal or dorsal spine clip (Table 1).

Multiple age classes of common carp and largemouth bass were evident when the length frequencies were examined indicating reproduction and recruitment in these species (Figures 3 & 4). The majority of the largemouth bass were between 240 and 340 mm total length. The majority of the common carp collected were larger (>400 mm) individuals. All bluegill collected were less than 150 mm and were likely age 1 and age 2 fish. Goldfish length frequencies showed two distinct age classes likely represented by age 1 and age 2 fish (Figure 6).

Catch per unit effort (CPUE) was highly variable by site and ranged from 0 to 209 fish per hour (Table 2). In general, CPUE was higher for east side sites than west side sites (Table 2). Catch per unit effort by species was higher in 2013 than compared to 2011 but substantially lower than 2009 (Table 3). Species composition has remained somewhat consistent with goldfish making up the majority of the catch every year since 2005, except for 2011 when largemouth bass comprised the majority of the catch (Table 4). Goldfish were rarely collected during surveys conducted prior to 2005 (Table 4). Common carp have been the second most collected fish each year since 2005 (Table 4).

Discussion

A total of 36 sites were sampled via electrofishing out of a total of 40 sites that were planned for sampling. The remaining four sites were not sampled due to a malfunction of the research electrofishing boat on the first evening. We collected 696 nonnative fish and one native fish for an overall CPUE of 76.6 fish/hour during the survey. We tagged and/or marked 470 of the nonnative fish throughout the sampling effort. However, we did not collect any tagged or marked fish from previous tagging efforts during this survey.

The CPUE for the 2013 survey was substantially higher than the 2011 survey. This is most likely due to the time of day the surveys were conducted and the gear types used. In 2011 the boat ramp was out of the water so electrofishing canoes were used to sample the shoreline during daylight hours. In 2013 the reservoir was sampled with electrofishing boats after dark. Although the reservoir was higher during 2013 survey catch rates were more than four-fold those in 2011. In 2009 catch rates were nearly seven-fold what they were in 2013. This is most likely because the 2009 survey was conducted at minimum pool. The 2009 survey utilized electrofishing canoes but fish were concentrated and maximum depth was less than 2 meters. This suggests that if the primary objective is to tag the most fish possible then sampling at minimum pool may be the most efficient.

USGS 09509501 HORSESHOE RESERVOIR AT HORSESHOE DAM, AZ.

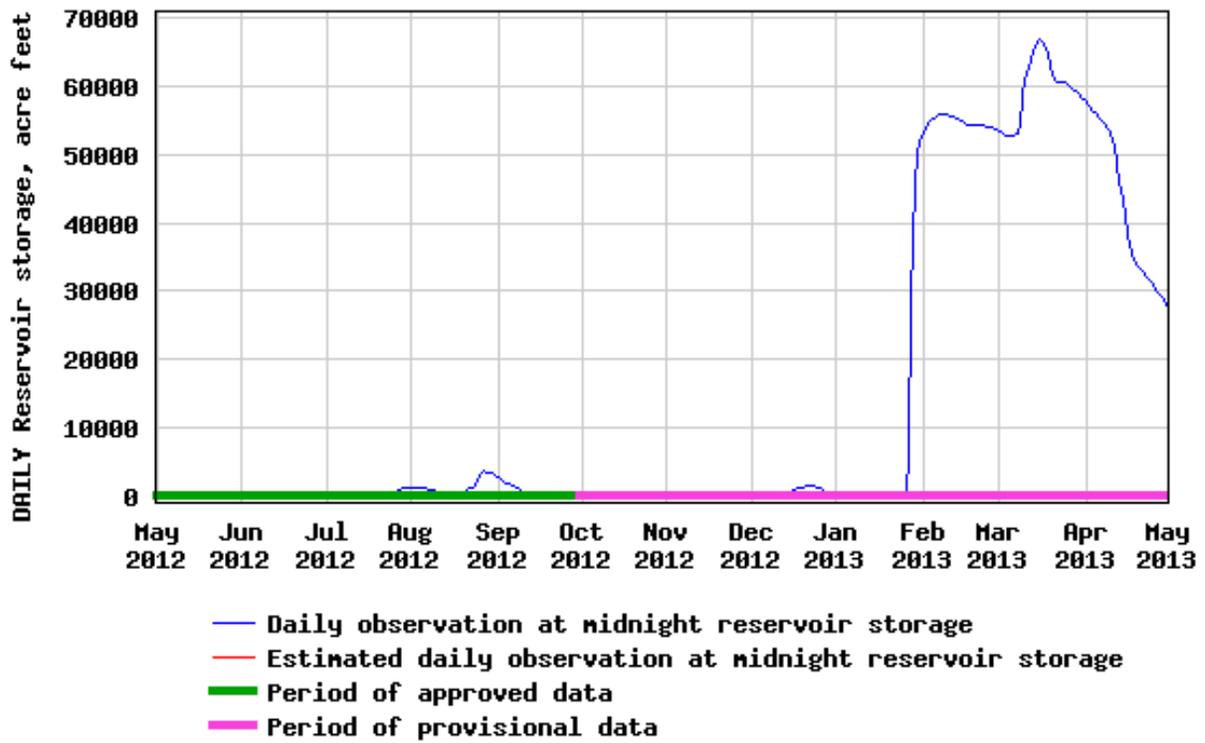
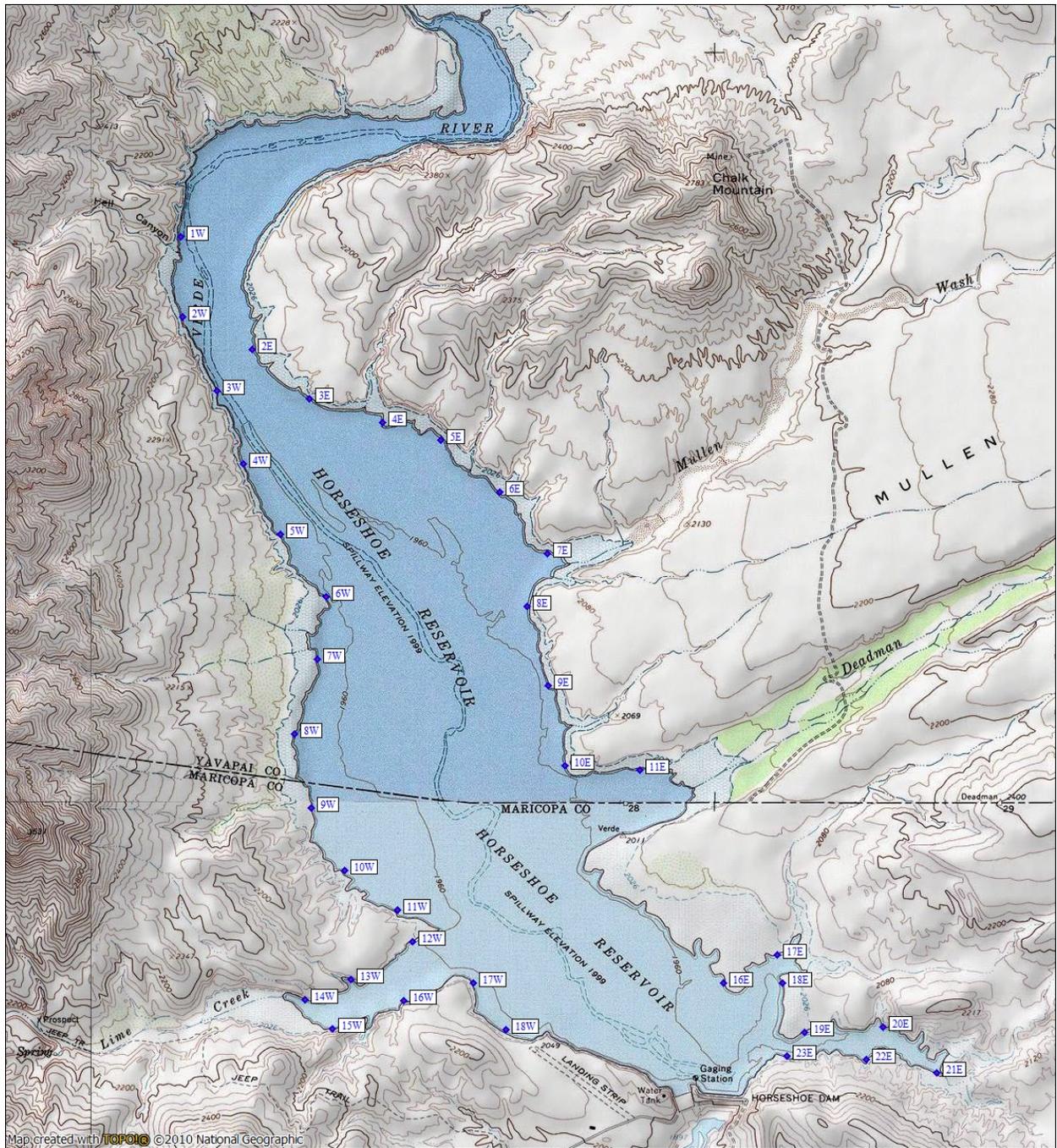


Figure 1: Horseshoe Reservoir water levels from May 1, 2012 to April 30, 2013.



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0.0 0.5 1.0 miles
0.0 0.5 1.0 1.5 km

TN MN
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Figure 2: Map of the sites sampled during the March 19-20, 2013 Horseshoe Reservoir survey.

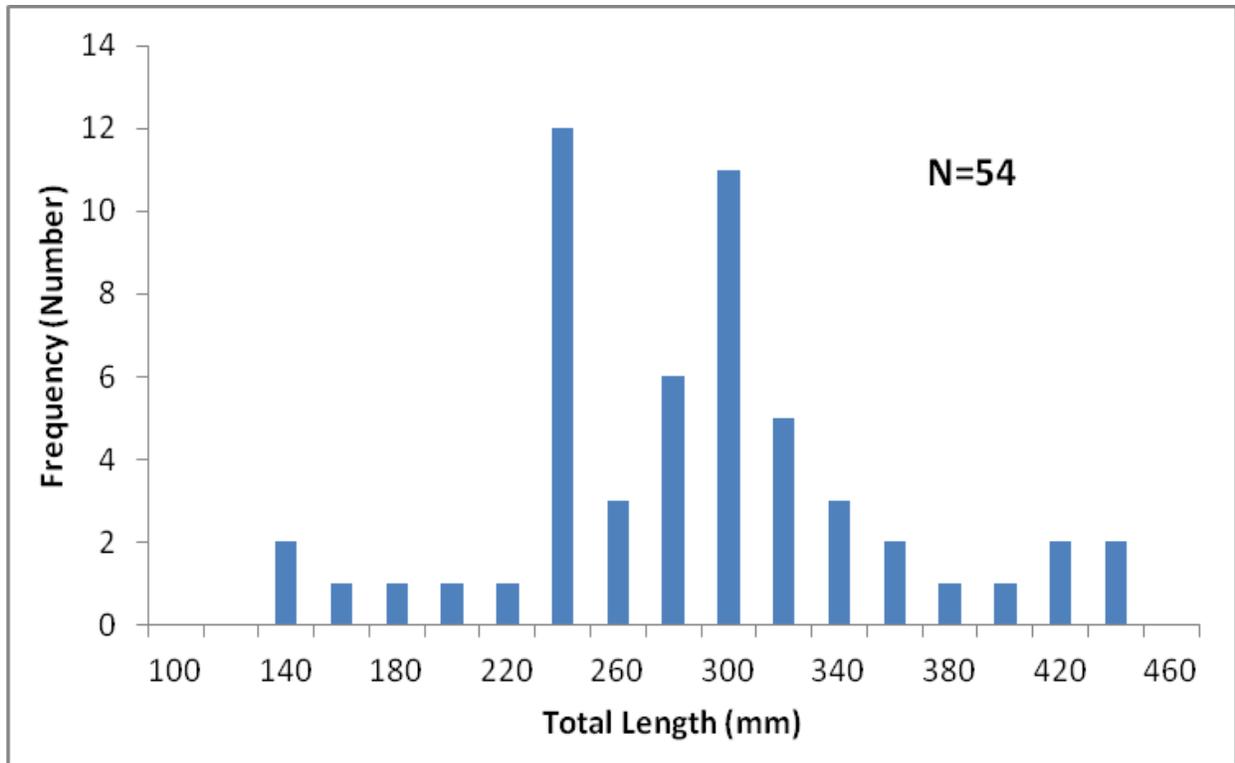


Figure 3: Length-frequency histogram for largemouth bass collected at Horseshoe Reservoir March 19-20, 2013.

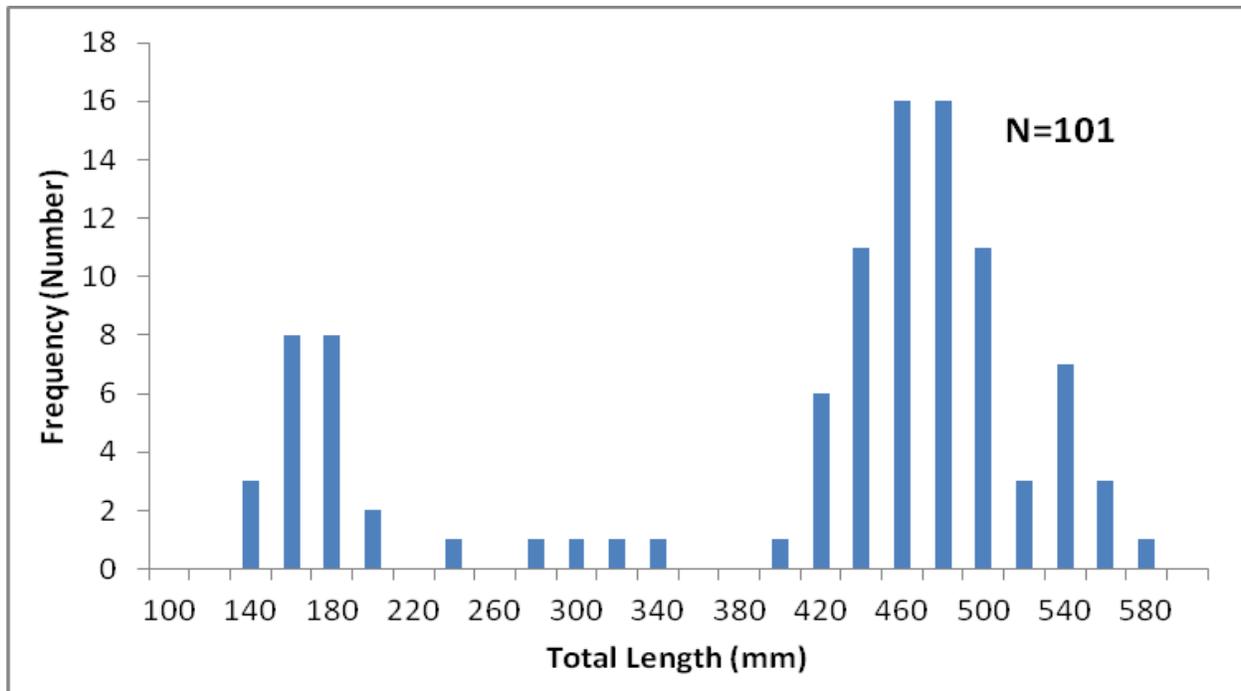


Figure 4: Length-frequency histogram for common carp collected at Horseshoe Reservoir March 19-20, 2013.

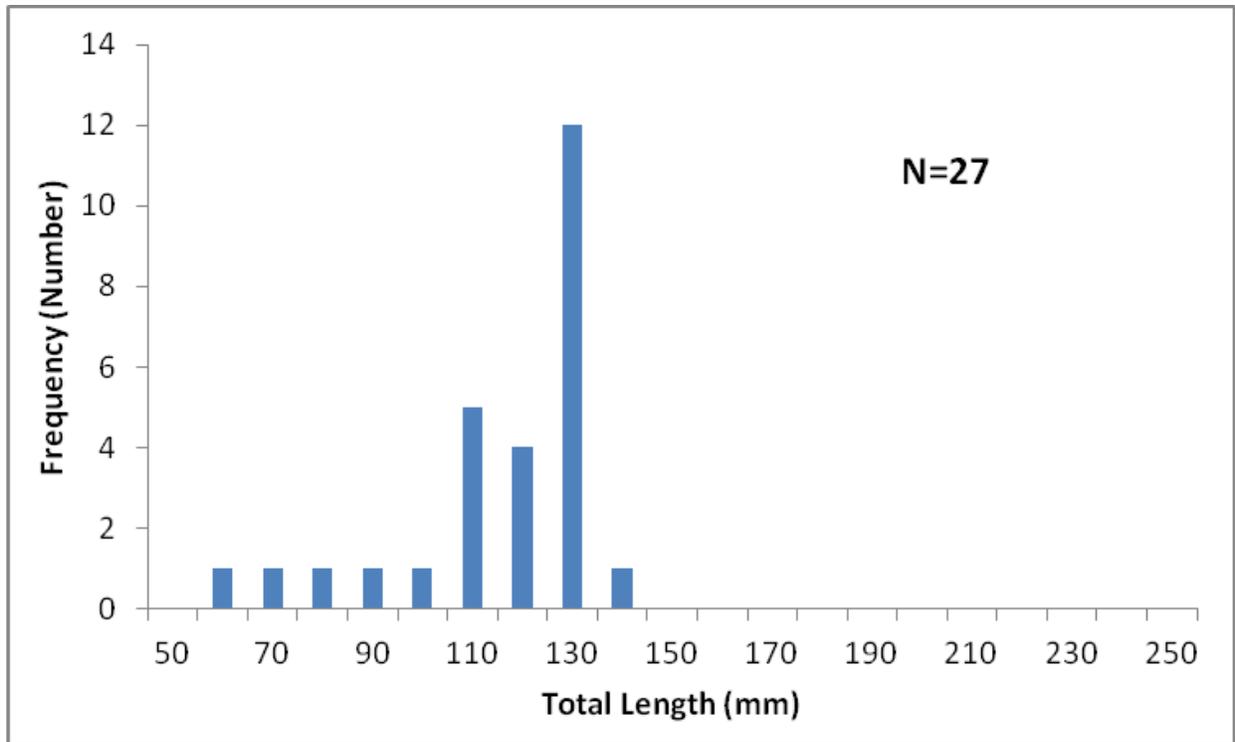


Figure 5: Length-frequency histogram for bluegill collected at Horseshoe Reservoir March 19-20, 2013.

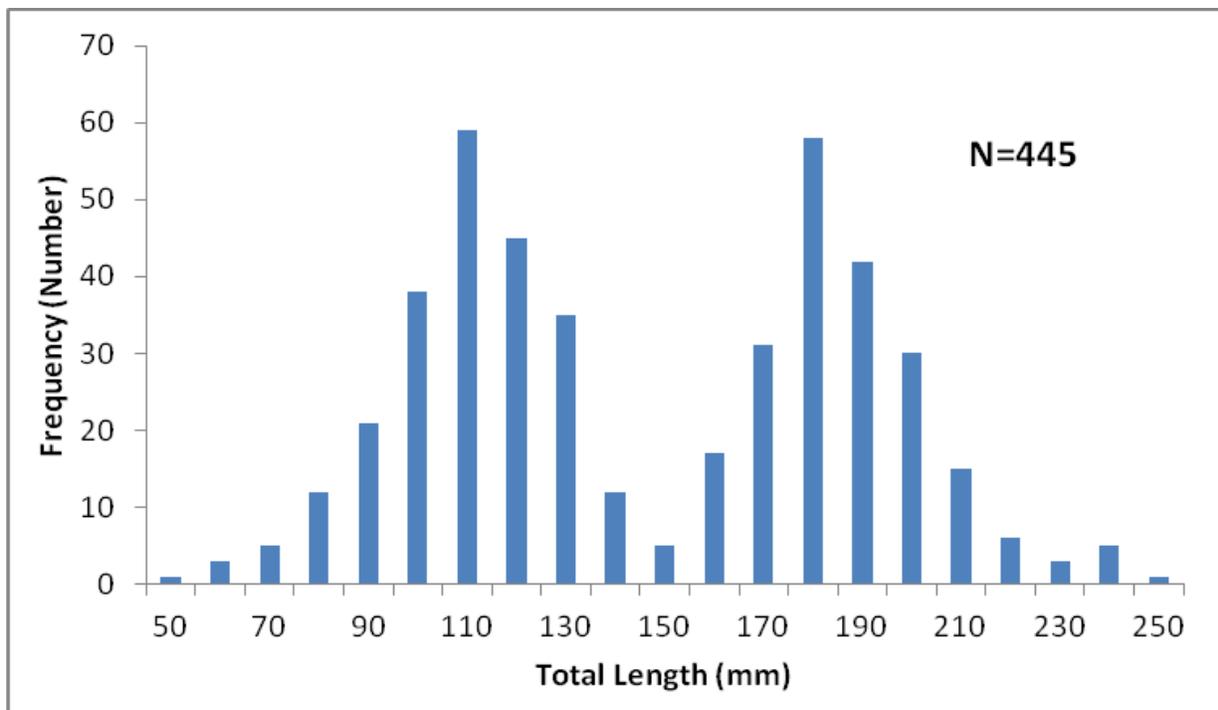


Figure 6: Length-frequency histogram for goldfish collected at Horseshoe Reservoir March 19-20, 2013.

Table 1: Summary Statistics and Catch per Unit Effort (CPUE) for fish collected during the Horseshoe Lake Survey, March 19-20, 2013. Species codes are yellow bullhead (AMNA), goldfish (CAAU), common carp (CYCA), red shiner (CYLU), mosquitofish (GAAF), channel catfish (ICPU), green sunfish (LECY), bluegill (LEMA), largemouth (MISA) and smallmouth bass (MIDO), and razorback sucker (XYTE).

Species	Total Length (mm)			Frequency		CPUE	Tag/Mark Type		
	MIN	MAX	Mean	Number	Percent	Fish/hr	FLOY	ANAL CLIP	DORSAL CLIP
AMNA	210	210	210	1	0.1	0.1	1		1
CAAU	50	241	142	445	63.8	48.9	202		227
CYCA	123	580	396	101	14.5	11.1	31	101	
CYLU*				33	4.7	3.6			
GAAF*				16	2.3	1.8			
ICPU	471	480	476	2	0.3	0.2	2		2
LECY	70	153	115	6	0.9	0.7	1		6
LEMA	53	131	111	27	3.9	3	0		27
MIDO	125	179	147	11	1.6	1.2	4		11
MISA	121	439	277	54	7.7	5.9	52		42
XYTE	448	448	448	1	0.1	0.1			
TOTAL				697	100	76.6	293	101	316

* = These species were not measured.

Table 2: Catch per Unit Effort (CPUE) in fish per hour by site for all species captured by electrofishing during the March 19-20, 2013 survey at Horseshoe Lake.

Site	CPUE (fish/hr)						
2E	74.6	11E	51.8	W1	0.0	W10	24.0
3E	127.9	16E	160.0	W2	0.0	W11	16.0
4E	180.0	17E	259.1	W3	0.0	W12	72.5
5E	120.0	18E	54.3	W4	0.0	W13	118.6
6E	208.8	19E	52.0	W5	14.2	W14	118.6
7E	144.5	20E	47.8	W6	180.0	W15	31.2
8E	68.0	21E	145.6	W7	60.8	W16	28.0
9E	76.0	22E	209.6	W8	56.1	W17	16.0
10E	63.2	23E	24.5	W9	28.0	W18	0.0

Table 3. Catch per Unit Effort (CPUE) for nonnative fish species captured in Horseshoe Lake during June 8-9, 2009, May 11-12, 2011, and March 19-20, 2013. CPUE = number of fish captured/hour electrofished.

Species	CPUE 2009	CPUE 2011	CPUE 2013
Goldfish	1649.92	0.72	48.87
Common carp	271.32	6.16	11.09
Red shiner	17.76	0.24	3.62
Mosquitofish	4.92		1.76
Channel catfish		0.36	0.22
Green sunfish	4.92	0.24	0.66
Bluegill	8.64	2.36	3.00
Largemouth bass	122.44	8.52	5.93
Smallmouth bass		0.12	1.21
Yellow bullhead		0.12	0.11
Total	519.99	18.68	76.55

Table 4. Percent composition of nonnative fish species captured by electrofishing in Horseshoe Reservoir, 1994-2013. Total fish collected for each survey is recorded at the bottom of the table.

Species	Year							
	1994	1998	1999	2005*	2006*	2009	2011	2013
Common carp	5.2	9.2	48.1	27.6	31.6	9.8	32.9	14.5
Goldfish		2.6		72.4	63.2	83.2	3.8	63.8
Red shiner	0.3		20.4		1.6	1.7	1.3	4.7
Golden shiner								
Threadfin shad	0.5	72.6						
Channel catfish		0.5			1	0.1	1.9	0.3
Flathead catfish			7.4					
Largemouth bass	42.1	5.8	11.1			4.5	45.6	7.7
Smallmouth bass	15.2	0.3	5.6				0.6	1.6
Black crappie	0.5	1.3						
Green sunfish		6.8	5.6			0.2	1.3	0.9
Bluegill	36.1	0.8	1.9			0.3	12	3.9
Yellow bullhead							0.6	0.1
Mosquitofish					2.6	0.2		2.3
Total # Collected	382	380	54	145	214	2126	158	697

* = 2005 and 2006 were fall surveys.

APPENDIX B

Verde River – Below Horseshoe Reservoir Survey Report
July 30-August 1, 2013
Arizona Game and Fish Department

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Verde River – Below Horseshoe Reservoir Survey Report

July 30 – August 1, 2013



Curt Gill

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Verde River – Below Horseshoe Reservoir Survey Report

Introduction:

From July 30 through August 1, 2013 Region VI Fish Program personnel sampled the Verde River from just below Horseshoe Reservoir downstream to near KA Ranch. The Verde River originates from Sullivan Lake south of Paulden, AZ and flows for about 210 km before it joins the Salt River near Mesa, AZ. The river had two reservoirs (Horseshoe and Bartlett) that supply irrigation water to central Arizona. We sampled the Verde River downstream of Horseshoe Reservoir, the uppermost of the two reservoirs. This effort was conducted in the hope of recapturing fish previously tagged/marked within Horseshoe Reservoir, most recently in March 2013, to determine the movements of these fish during extremely low water levels.

Methods:

Standard 45.6 x 1.8 meter monofilament experimental gill nets were used with 7.6 meter panels of varying mesh sizes (i.e. 1.2, 2.5, 3.8, 5.0, 6.3 and 7.6 cm). The top line is made with a 1 cm poly foam float line and the bottom lead line is a 13.5 kg lead core line. Gill nets were set parallel to the shoreline in greater than two meters of water. Experimental gillnets were set with large and small mesh sizes randomly placed upstream or downstream. Nets were set in the late afternoon and pulled the following morning, in an effort to have them in the water for at least a 12-hour period. Six gill nets were set on July 30, 2013 just below Horseshoe Reservoir downstream to KA Ranch (Figure 1). Four gill nets were re-set on July 31 in the large pool below Horseshoe Reservoir where GN1 and GN2 were set the previous afternoon (Figure 1). We also opportunistically sampled backwaters using a 7.6 meter bag seine. Only one suitable backwater was encountered on the survey. All fish collected were measured to the nearest millimeter. The exception was threadfin shad (*Dorosoma petenense*) and red shiner (*Cyprinella lutrensis*), which were counted only. All sportfish collected were weighed to the nearest gram. Catch per unit effort (CPUE) for gill netting was calculated in fish/hour. Descriptive statistics were calculated for all species collected except those that were counted only. Length frequencies were calculated by for all fish that were measured.

Results and Discussion:

Ten gill nets were set over the two nights for a total of 206.7 hours of effort (Table 1). There were a total of 201 fish were collected comprising eight species using gill nets (Table 2) and 14 fish were collected comprising five species using a seine during the survey. In all, nine fish species were collected during the survey. The only species collected in the two seine hauls that was not collected in gill nets was red shiner. The other eight species collected consisted of yellow bullhead (*Ameiurus natalis*), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), threadfin shad, channel catfish (*Ictalurus punctatus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and flathead catfish (*Pylodictis olivaris*). Common carp (0.29/hour) had the highest CPUE during gill netting followed by goldfish (0.194), flathead catfish (0.14), channel catfish (0.131), and largemouth bass (0.126) (Table 2). The other three fish species sampled via gill netting had a CPUE below 0.10 fish/hour (Table 2). Overall CPUE was 0.97 fish per hour during the gill netting survey.

The total length of the backwater sampled was 90 m. We completed two seine haul, both roughly 45 m long, through the backwater and collected six threadfin shad, four bluegill, two largemouth bass, one red shiner, and one common carp.

Common carp collected during the survey averaged 406 mm in length while goldfish averaged 163 mm long (Table 2). We noted multiple size classes of common carp and goldfish indicating that they are reproducing in the system (Table 3). All common carp and all but seven goldfish collected were larger than 150 mm, as were all of the sportfish collected except for three largemouth bass and two bluegill (Table 3). Although we collected 173 nonnative fish that were large enough to have been tagged/marked during our March tagging effort in Horseshoe Reservoir, no tagged/marked fish were collected during this survey. To date, no tagged/marked fish have been collected during monitoring efforts outside of Horseshoe Reservoir in recent years, although more than a thousand fish have been tagged/marked within the reservoir since 2009. This suggests that fish are not moving out of Horseshoe Reservoir as it drains, at least not in large numbers. Many fish likely die when the reservoir annually reaches minimum pool and the remainder persist within the minimum pool. Future survey sampling effort may want to consider other methods (e.g. radio telemetry) to definitively determine whether fish do emigrate from Horseshoe Reservoir as it drains to minimum pool.

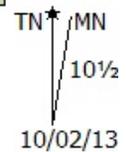
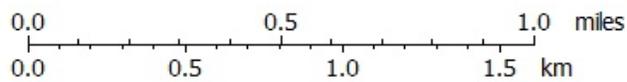
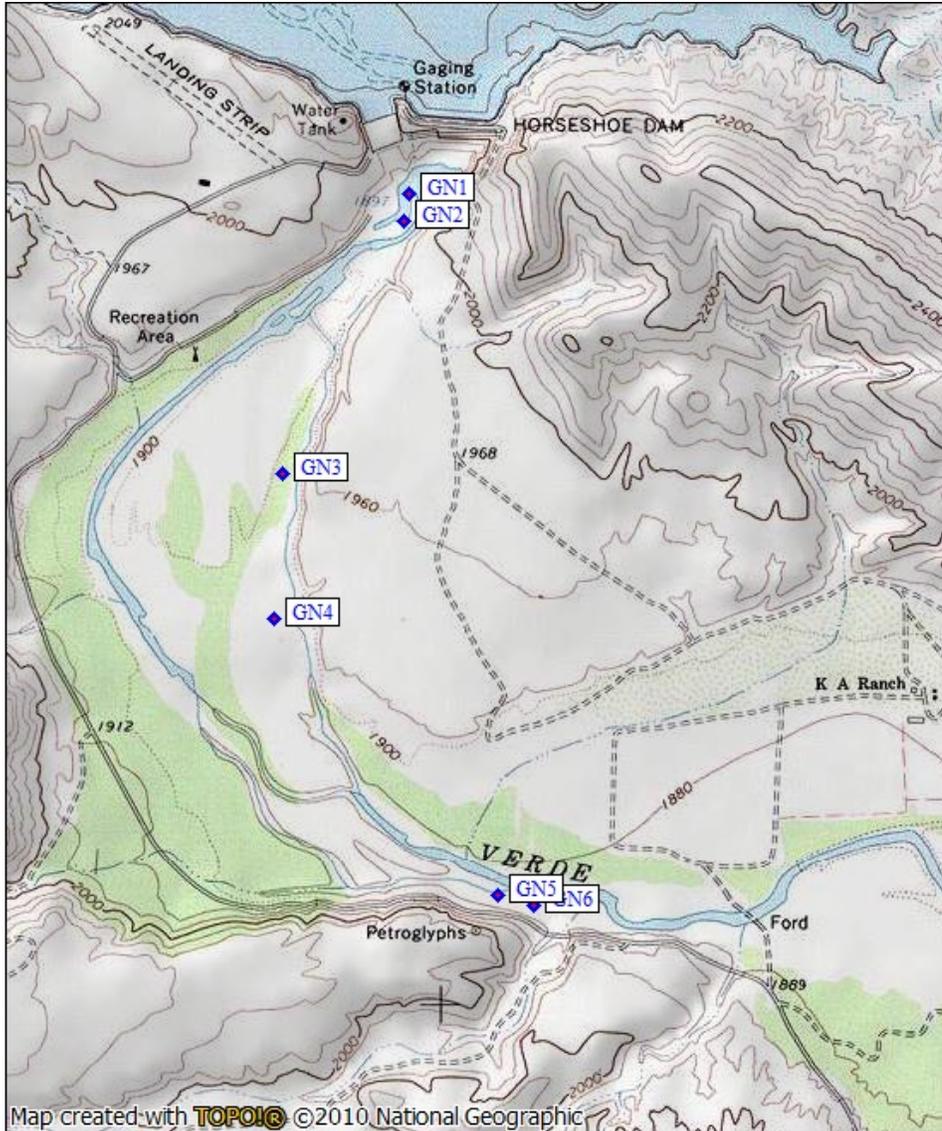


Figure 1. Map of the Verde River sampling locations, between Horseshoe Reservoir and KA Ranch, sampled with gill nets July 30 – August 1, 2013.

Table 1. Gill net catch, effort (hours), and catch per unit effort (fish/hour) by site for the Verde River, Horseshoe Reservoir to KA Ranch, July 30 – August 1, 2013.

Site ID	Catch	Effort	CPUE
GN1	40	19.25	2.1
GN2	44	19.58	2.2
GN3	14	19.58	0.7
GN4	7	19.75	0.4
GN5	5	19.67	0.3
GN6	2	20.00	0.1
GN7	19	21.25	0.9
GN8	24	21.58	1.1
GN9	35	22.58	1.5
GN10	11	23.42	0.5
TOTAL	201	206.67	1.0

Table 2. Descriptive statistics for the gill net survey on the Verde River, Horseshoe Reservoir to KA Ranch, July 30 – August 1, 2013.

Species	Catch	%	Length (mm)			Mean Weight (g)	CPUE (fish/hr)
			Composition	Mean	Min		
AMNA	1	0.5	195	195	195	NR	0.005
CAAU	40	19.9	163	77	241	NR	0.194
CYCA	60	29.9	406	170	590	NR	0.290
DOPE	16	8.0	NR	NR	NR	NR	0.077
ICPU	27	13.4	325	237	486	311	0.131
LEMA	2	1.0	100	80	120	22	0.010
MISA	26	12.9	219	95	420	221	0.126
PYOL	29	14.4	438	211	790	1378	0.140
Total	201	100					0.973

Table 3. Length frequency table for the species collected (excluding threadfin shad) during the gill net survey on the Verde River, Horseshoe Reservoir to KA Ranch, July 30 – August 1, 2013.

Length Range (mm)	AMNA	CAAU	CYCA	ICPU	LEMA	MISA	PYOL
0-99	0	2	0	0	1	1	0
100-149	0	5	0	0	1	2	0
150-199	1	27	2	0	0	15	0
200-249	0	6	0	2	0	2	1
250-299	0	0	4	7	0	0	0
300-349	0	0	5	10	0	2	8
350-399	0	0	18	5	0	3	5
400-449	0	0	17	2	0	1	5
450-499	0	0	4	1	0	0	3
500-549	0	0	5	0	0	0	0
550-599	0	0	5	0	0	0	3
>600	0	0	0	0	0	0	4
Total	1	40	60	27	2	26	29

APPENDIX C

Northern Mexican Gartersnake 2013 Summary Report
Salt River Project Camp Verde Riparian Preserve

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**Northern Mexican Gartersnake 2013 Summary Report
Salt River Project Camp Verde Riparian Preserve**

October 25, 2013

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and
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2013 Survey Efforts

We conducted minnow trap and visual encounter surveys at the Salt River Project (SRP) Camp Verde Riparian Preserve from April through October 2013 (Table 1). Survey efforts totaled 44,838.36 trap-hours and 236.49 person-hours for minnow trap surveys, and 24.25 hours for visual encounter surveys. We detected 64 new northern Mexican gartersnake (*Thamnophis eques megalops*) individuals and 38 recaptures from snakes initially captured in 2012 and 2013. We have currently documented 90 Mexican gartersnakes from 2012-2013, placing this population within the top three sites in Arizona and the United States for numbers of confirmed individuals. Northern Mexican gartersnake detections (with one exception along the mainstem river) were associated with backwater ponds, pools, and channels created by beaver activity and previous flood events. These locations featured dense emergent and riparian vegetation including cattail, bulrush, and sedge species, and riparian obligate trees including willow and cottonwood. We documented gartersnake predation of three species from witnessed consumption or regurgitation during processing and measuring. Prey species included American bullfrog (*Rana catesbeiana*), mosquitofish (*Gambusia affinis*), and largemouth bass (*Micropterus salmoides*).

We documented additional reptile, amphibian, and fish species with corresponding numbers detected during surveys, including: 3 Sonora mud turtle (*Kinosternon sonoriense*); 4 adult and juvenile Woodhouse's toad (*Bufo woodhousii*); 2,630 American bullfrog (183 adults and juveniles and 2,447 tadpoles); 938 unidentified tadpoles (either Woodhouse's toad or American bullfrog) 4,032 mosquitofish; 389 green sunfish (*Lepomis cyanellus*); 3 bluegill (*Lepomis macrochirus*); 415 largemouth bass; 91 red shiner (*Cyprinella lutrensis*); 1 black bullhead (*Ameiurus melas*); 3 yellow bullhead (*Ameiurus natalis*) and 1 common carp (*Cyprinus carpio*). We also captured 168 northern crayfish (*Orconectes virilis*).

Table 1. Survey effort and gartersnakes detected by minnow traps (“trap”) and visual encounter surveys (“VES”) during surveys for Mexican gartersnakes in the Salt River Project Camp Verde Riparian Preserve, Arizona, 2013.

Dates Surveyed	Survey Method	Trap #	Survey-hours	Trap- hours	Gartersnakes detected
04/26-04/30/13	trap	70	39.7	6625.51	2 new
	VES	-	6	-	1 new (deceased remains)
05/13-05/19/13	trap	75	73.6	10642	28 new 22 recaptures
	VES	-	1	-	none
06/27, 06/29/13	VES	-	11	-	none
07/15-07/21/13	trap	60	68.16	8640	10 new 4 recaptures
	VES	-	6.25	-	none
07/24-07/30/13	trap	60	28.83	8403	6 new (1 deceased remains) 4 recaptures
09/26-10/04/13	trap	50	22.7	9431.65	12 new (2 incidental near traps) 8 recaptures
10/19-10/22/13	trap	15	3.5	1096.2	5 new

2013 Radio Telemetry

We are currently tracking eight gartersnakes (seven female, one male) fitted with radio transmitters as part of a multi-year habitat selection and spatial ecology study. We are using three large (5.0 g) and five small (1.0 g) transmitters, with a nominal battery life of one year and six weeks, respectively. The larger transmitters are being used to determine habitat selection and individual movements throughout the year, while the smaller transmitters are being used to document hibernacula location and site fidelity, and communal denning behavior. Five individuals (all female) are located at the eastern end of the property, near an extensive backwater channel created by beaver dam activity north of the mainstem river. Three of these snakes have larger transmitters, while the remaining two are fitted with smaller transmitters. Two individuals (one female and one male) are located at the central to eastern part of the property in another backwater channel created by beaver dam activity south of the mainstem river. Both of these snakes are fitted with smaller transmitters. One individual (female) is located at the western end of the property near a backwater pool created from a previous flood event south of the mainstem river, and also has a smaller transmitter. Two of the snakes that contain larger transmitters at the east end of the property have been tracked since May and August 2013, while the remaining individuals were fitted with transmitters more recently in mid-October. While data collection and analysis is in preliminary stages at this time, snakes have remained within 60 m of the backwater areas where they were initially captured. Telemetered gartersnakes have primarily been associated with surface vegetation and flood debris piles near aquatic edges bordering floodplain woodland and wetland habitat.