

COLORADO RIVER RECOVERY PROGRAM
FY 2018 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 169

I. Project Title: Detecting endangered fishes using PIT tag antenna technology in the Upper Colorado River Basin

II. Bureau of Reclamation Agreement Number: R15PG00083

Project/Grant Period: Start date: 10/01/2014
End date: 09/30/2019
Reporting period end date: 09/30/2018
Is this the final report? Yes _____ No X

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IV. Abstract:

Portable PIT tag antennas allow researchers to detect PIT-tagged fish in remote locations with minimal infrastructure, labor, or maintenance. During 2018, the Green River Basin Fish and Wildlife Conservation Office (GRB-FWCO) deployed portable antennas at three known spawning locations in the Green and Yampa Rivers in Dinosaur National Monument (Figure 1) with the intention of detecting as many endangered razorback sucker, Colorado pikeminnow, and bonytail as possible. Out of 7,197 detections, we were able to identify 1,464 individual or unique tags. These unique tags represented 1,258 razorback sucker, 132 Colorado pikeminnow, 6 bonytail, 11 roundtail chub, 40 flannelmouth sucker, 7 bluehead sucker, and 10 razorback x flannelmouth sucker hybrids (Figure 2).

V. Study Schedule: 2012-ongoing.

VI. Relationship to RIPRAP:
General Recovery Program Support Action Plan
V.A.1.a.(2). Investigate improving recapture rates through passive PIT tag monitoring, nets, etc. to improve population abundance estimates.
Green River Action Plan: Mainstem
V.D.1. Implement razorback sucker monitoring plan.

VII. Accomplishment of FY 2018 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Razorback Bar

The GRB FWCO deployed seven stand alone or “submersible” antennas on 21 March at Razorback Bar on the Green River, where the majority of PIT tag detections in this study occurred (Figure 2, Smith et al. 2015, Smith et al. 2016, Smith et al. 2017). Two of these antennas were retrieved on 2 April and deployed in Echo Park three days later. The five remaining antennas were retrieved on 1 June. During this period we detected unique PIT tag codes associated with 1,257 razorback sucker, 30 Colorado-pikeminnow, 21 flannelmouth sucker, five bluehead sucker, and 8 razorback x flannelmouth sucker hybrids (Table 1).

Razorback sucker

More razorback sucker were detected at Razorback Bar in 2017 than in 2018, however razorback sucker detections were still more numerous this year than during the first five years of this study. The number of daily detections increased beginning 5 April and decreased after 12 May (Figure 3). Most of the razorback sucker detected were stocked from 2009 to 2013 as 1+ year olds (Figure 4) and would presumably be sexually mature. The earliest stocking date of any fish detected was 6 June 2000. This individual, which carried a 400 kilohertz (kHz) PIT tag when it was stocked in Stewart Lake near Jensen, Utah, eluded capture until June 2017 when it also received a newer 134 kHz PIT tag. It is possible that other fish carrying only 400 kHz tags were present but not detected at Razorback Bar because submersible antennas do not detect these older tags. The Recovery Program replaced 400 kHz tags with 134 kHz tags in 2004.

Razorback sucker previously detected at Razorback Bar that were detected again in 2018 include 52 in 2017, 137 individuals in 2016, 54 in 2015, 38 in 2014, 13 in 2013, and two in 2012. In total, 19.3 percent (N = 243) of the razorback sucker detected at Razorback Bar in 2018 had been previously detected by antennas at this spawning location at least once since 2012. Webber and Beers (2014) found that the majority (93%) of razorback sucker detected at Razorback Bar in 2012-2013 had not been previously captured during active river sampling. The majority or 73.3 percent of razorback suckers detected in 2018 had not been captured since stocking, and 52.5 percent had neither been captured nor previously detected by PIT tag antennas. The latter proportion decreased markedly from 73 percent in 2017, possibly the effect of more extensive PIT tag antenna coverage at Razorback Bar and throughout the Green River Basin in recent years.

Ouray National Fish Hatchery (ONFH) stocked 98.5 percent (N=1,238) of the razorback sucker detected at Razorback Bar. An additional two razorbacks were stocked at Green River, Utah by the Grand Valley Unit of ONFH and 17 fish (1.5%) that could have lost their hatchery tags were tagged by field crews (Utah Division of Wildlife Resources [UDWR] Vernal and GRB FWCO). Four razorback sucker that were stocked in the White River at the Enron boat ramp on 19 April were detected 23 & 24 May at Razorback Bar. Excluding these four individuals, all razorback sucker detected this year

were stocked in the Green River between Rainbow Park and Green River, Utah.

For the third year in a row, razorback sucker that have ventured outside of the Green River Basin were observed at Razorback Bar. Seven razorback sucker previously encountered in the Colorado River or Lake Powell were detected in 2018 (Figure 5). These include one individual that was stocked at Green River, Utah in 2011, captured in the Grand Valley, Colorado in 2015, detected in Lake Powell in May 2017, detected again at the Tusher Diversion Dam in August 2017, and finally detected at Razorback Bar in April 2018. Combined with the ten individuals detected at this site in 2016 and 2017 that had previously been encountered in the Colorado River, these detections hint at a more extensive exchange between razorback sucker in the Green and Colorado rivers, and perhaps Lake Powell, than previously thought. Along with recent documentation of successful spawning in Lake Powell (T. Francis, Grand Junction FWCO, personal communication), known wild recruitment in Lake Mead, and observed upstream migration into lower Grand Canyon (Albrecht et al. 2014), these records suggest that reservoirs may be more important habitat for various life stages of the species than previously thought.

Prior to the 2016 launch of STReaMS (www.streamsystem.org), the Recovery Program's online database, these encounter histories would have been more easily overlooked. The accessibility of this database combined with the extensive field sampling and the increasing use of PIT tag antennas throughout the Upper Colorado River Basin will likely reveal trans-basin movements such as these more frequently in the future.

Other Species

Thirty Colorado pikeminnow were detected at Razorback Bar in 2018 compared to 20 in 2017. Unlike razorback sucker, Colorado pikeminnow in the Upper Green River Basin are reared in the wild and tagged by field crews. Excluding two fish missing PIT tag deployment records, the majority (N = 23) of Colorado pikeminnow detected at this site in 2018 were tagged in the Green River between RM 38.5 and RM 349.4. The five remaining traceable individuals were tagged in the Yampa River (n = 3) between RM 41.1 and RM 72.9, the White River at RM 19.2, and the Colorado River at RM 19.1 (Figure 4). Among the pikeminnow detected that were lacking initial tagging information was one individual that was captured by Grand Junction FWCO field crews at Colorado River RM 106.8 in October 2015 and Colorado River RM 3.6 in June 2015, then captured by a UDWR Vernal field crew at Green River RM 319.1 in April 2016. This fish was also detected at Razorback Bar in 2017 and reported in last year's Project 169 Annual Report (Figure 5; Smith et al. 2017).

Razorback Bar antennas also detected tags from 21 flannelmouth sucker, five bluehead sucker, and 8 flannelmouth x razorback sucker hybrid. All were PIT-tagged by UDWR Vernal. Unlike the past four years, bonytail were not detected at Razorback Bar in 2018, nor were roundtail chub.

Spawning Bars on the Yampa River

Using the same approach as Razorback Bar on the Green River, we expanded the range of this project in 2015 by adding two locations on the Yampa River in Dinosaur National Monument by setting submersible PIT tag antennas at known spawning bars. Unlike Razorback Bar, the new sites are located within river stretches that are managed as wilderness by the National Park Service and receive a high amount of recreational river use. Submersible antennas are less intrusive than other PIAs, which require more surface infrastructure (batteries, solar panels, etc.) to operate, and allow us to monitor native and endangered fish presence without compromising wilderness qualities, impacting user experience, or risking the chance of vandalism or tampering.

Echo Park Bar

The spawning bar that we refer to as Echo Park Bar is located 0.3 miles upstream from the Green-Yampa River Confluence and two submersible antennas were set at this location from 5 April to 5 July. Although rare, the majority of razorback sucker captures on the Yampa River in recent years have occurred at or near this gravel bar, and researchers documented spawning at this site prior to the razorback sucker Federal listing under the Endangered Species Act in 1991 (Tyus and Karp 1990).

In total, 103 identifiable unique tags were detected at Echo Park Bar in 2018, consisting of one razorback sucker, 74 Colorado pikeminnow, 6 bonytail, 4 roundtail chub, 19 flannelmouth sucker, 2 bluehead sucker, and 2 flannelmouth x razorback sucker hybrids (Table 2). This represents a noticeable increase from 2017, primarily for Colorado pikeminnow detections. The majority of unique detections ($n = 78$) were recorded by one antenna that was placed off the right shore of the Yampa River with a pack raft. Prior to 2018 and our incorporation of the pack raft in this project, antennas at Echo Park Bar were limited to the left shore since this site is accessed by foot during most of the sampling season.

Of the 74 Colorado pikeminnow detected at Echo Park Bar in 2018, 47 were PIT-tagged in the Green River (RM 0.0 – RM 350.6), fifteen in the Yampa River (RM 0.2 – RM 103.4), two in Vermillion Creek, and one in the Colorado River (RM 19.1). Deployment records do not exist in the STReAMS database for the nine remaining PIT tags. Thirty-six of the 74 Colorado pikeminnow detected at Echo Park Bar in 2018 have not been captured since they were PIT-tagged, yet 16 of these fish had been detected by antennas prior to 2018. Additionally, two of these Colorado pikeminnow were detected in early May before they were detected at Cleopatra's Couch in June 2018.

All bonytail detected at Echo Park Bar in 2018 were stocked at Yampa River RM 11.8 on 7 September 2016 ($n = 2$) and 10 August 2017. Although bonytail detections at Echo Park decreased from 2017, these fish still demonstrated overwinter survival.

Cleopatra's Couch Bar

Cleopatra's Couch Bar is located at Yampa River mile 16.5 and is one of two gravel bars in the Upper Green River Basin that have been extensively documented as Colorado-pikeminnow spawning locations. Three submersible antennas were deployed at or near

this spawning bar on 7 June and retrieved on 21 June because of dropping flows on the Yampa River. Deployment, data retrieval and maintenance of these antennas was conducted concurrently with Project 110 (Lower Yampa Nonnative Management). The antennas allowed the collection of presence-absence information pertaining to Colorado pikeminnow at this spawning bar that otherwise would not have occurred because GRB FWCO field crews do not shock this reach due to the potential for electrofishing-induced spawning disruption.

In total, we were able to locate codes for 36 individual fish, which consisted of 29 Colorado pikeminnow and 7 roundtail chub (Table 3). Among the roundtail chub detected, five had been tagged in the Yampa River between RM 8.5 – RM 15.9 during Project 110 fish community monitoring passes, one was tagged on the Green River in Echo Park (RM 342) by the Colorado State University Larval Fish Lab (LFL) as part of Project FR-115. Including one fish that did not have tag deployment records, two of the roundtail chub detected at this site in 2018 had been captured since they were tagged.

The proportion of Colorado pikeminnow tagged in the Yampa River detected at Cleopatra's Couch Bar in 2018 (21% or six individuals) was similar to that of 2017 (19% or four individuals); the majority in both years were tagged in the Green River. One fish was PIT tagged in the White River and another in Vermillion Creek. Four of the Colorado pikeminnow detected in 2018 were also detected at this site between 2015 and 2017, and nine were recorded at Echo Park Bar between two to five weeks before detection at Cleopatra's Couch. The maximum time at large without capture for a Colorado pikeminnow detected at Razorback Bar in 2018 was 11 years for a fish tagged by USFWS Vernal in April 2007 at Green River RM 197.8

PIT tag antenna data collected from antennas placed in locations throughout the Green River Basin combined with other encounter history data sourced from STReaMS (www.streamsystem.org), the Recovery Program's online database, can reveal Colorado pikeminnow movements not previously documented. Although this species is known to be highly migratory, this relatively new technology and data accessibility contributes important life history information that would otherwise require additional expense and time (i.e. radio telemetry). Beyond providing new life history information and increased individual detections that could contribute to more robust survival estimates, PIT tag antenna data can help guide hatchery management by providing metrics such as the relative strength of stocking year classes.

Shortcomings

For the second year in a row, the hydrology in the Yampa River was such that our sampling window of opportunity at Cleopatra's Couch was shorter than the previous year. Although we recorded three more unique tags at Cleopatra's Couch than in 2017, we would expect to have detected more PIT tags had the sampling period lasted longer than two weeks.

VIII. Additional noteworthy observations:

IX. Recommendations:

- Continue using PIT tag antennas to monitor fish at Razorback Bar, Echo Park Bar, and Cleopatra's Couch Bar. The congregation of fish in these locations for spawning increases the chances for detection of individuals that may otherwise be spread over large distances. Furthermore, PIT tag antennas provide an unobtrusive method of monitoring endangered fishes at spawning locations as opposed to electrofishing, which can disrupt spawning behavior and egg viability.
- Continuing the use of these antennas during years where razorback sucker are collected during field work could allow for better survival estimates, and perhaps derived population estimates.
- Compare dates of high razorback sucker detections to back-calculated age for larvae collected. This may allow us to determine if these tag detections can be used as a relative index of spawning activity. It would also increase our confidence that fish detected at this location are likely engaging in spawning activity.

X. Project Status: This project is on track and ongoing

XI. FY 2018 Budget Status

A. Funds Provided: \$21,977.00

B. Funds Expended: \$21,977.00

C. Difference: -0-

D. Percent of the FY 2017 work completed: 100%

E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission: Data was submitted to the database manager on 19 September 2018.

XIII. Signed: Christian Smith 11/15/2018
Principal Investigator Date

Literature Cited

- Albrecht, B., R. Kegerries, J.M. Barkstedt, W.H. Brandenburg, A.L. Barkalow, S.P. Platania, M. McKinstry, B. Healy, J. Stolberg, and Z. Shattuck. 2014. Razorback Sucker *Xyrauchen texanus* Research and monitoring in the Colorado River inflow area of Lake Mead and the lower Grand Canyon, Arizona and Nevada. Final report prepared by BIO-WEST, Inc., for U.S. Bureau of Reclamation, Upper Colorado Region, Salt Lake City, UT.
- Jones, M.T., C.T. Smith, and D. Beers. 2016. Middle Green River Floodplain Sampling. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Smith, C.T., M.T. Jones, and D. Beers. 2017. Detecting endangered fishes using PIT tag antenna technology in the Upper Colorado River Basin. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Tyus, H.M. and C.A. Karp. 1990. Spawning and Movements of Razorback Sucker, *Xyrauchen texanus*, in the Green River Basin of Colorado and Utah. The Southwestern Naturalist 35 (4): 427-433.
- Webber, P.A. and D. Beers. 2014. Detecting razorback suckers using passive integrated transponder tag antennas in the Green River, Utah. Journal of Fish and Wildlife Management 5: 191-196. Figure 1. Year of stocking for razorback sucker detected with the PIT antennas in 2014.

Table 1. PIT tag antenna detections of unique codes per species at Razorback Bar, UT in 2018.

Species	Number of Unique Tags Detected
Razorback sucker	1,257
Flannelmouth sucker	21
Bonytail	0
Colorado pikeminnow	30
Flannelmouth x razorback sucker	8
Bluehead sucker	5
Roundtail chub	0
Total	1,321

Table 2. PIT tag antenna detections unique codes per species at Echo Park Bar, CO in 2018.

Species	Number of Unique Tags Detected
Colorado pikeminnow	74
Flannelmouth sucker	19
Bonytail	6
Roundtail chub	4
Bluehead sucker	2
Razorback sucker	1
Flannelmouth x razorback sucker	2
Total	108

Table 3. PIT tag antenna detections of unique codes per species at Cleopatra's Couch-Bar, CO in 2018.

Species	Number of Unique Tags Detected
Colorado pikeminnow	28
Bonytail	0
Roundtail chub	7
Total	35

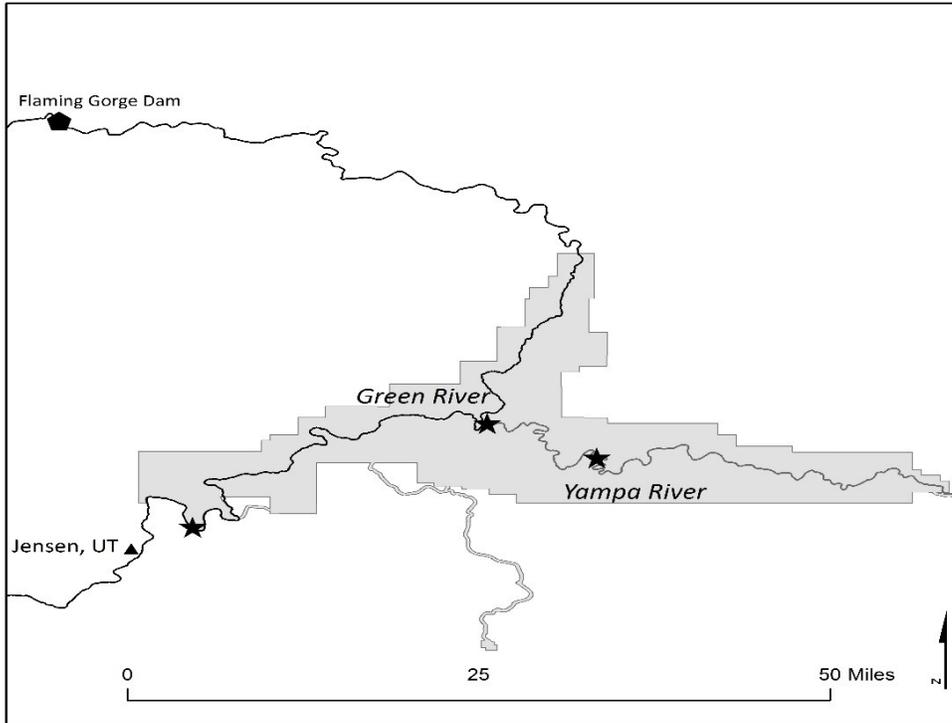


Figure 1. Locations of PIT tag antenna arrays set by Green River Basin FWCO in 2018 indicated by stars. The shaded polygon shows the extent of Dinosaur National Monument.

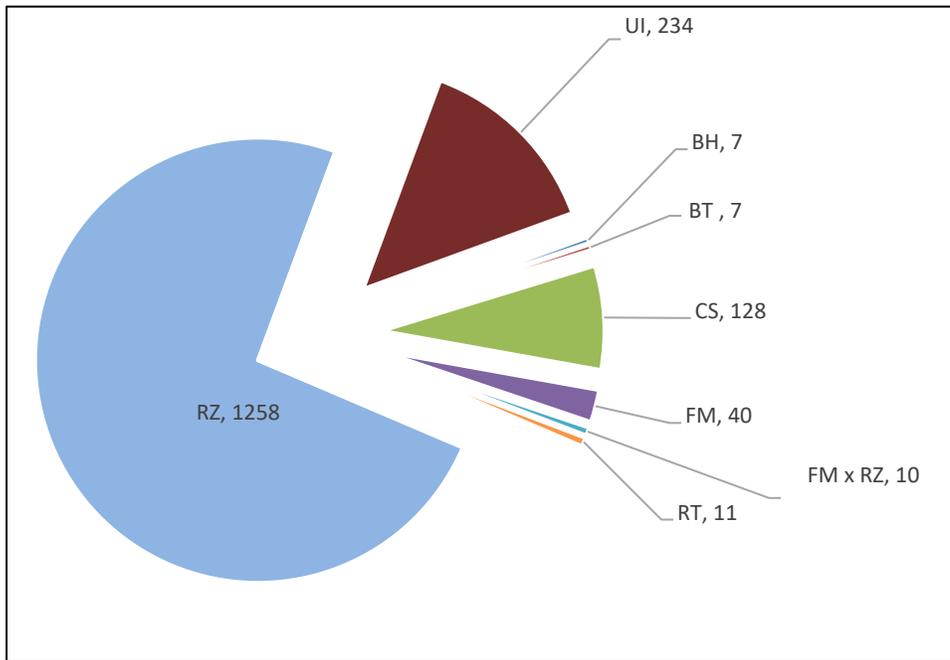


Figure 2. Relative proportion and number of PIT-tagged fish detected at Passive Interrogation Arrays (PIAs) set at Razorback Bar on the Green River, Echo Park Bar on the Yampa River, and Cleopatra's Couch Bar on the Yampa River in 2018.

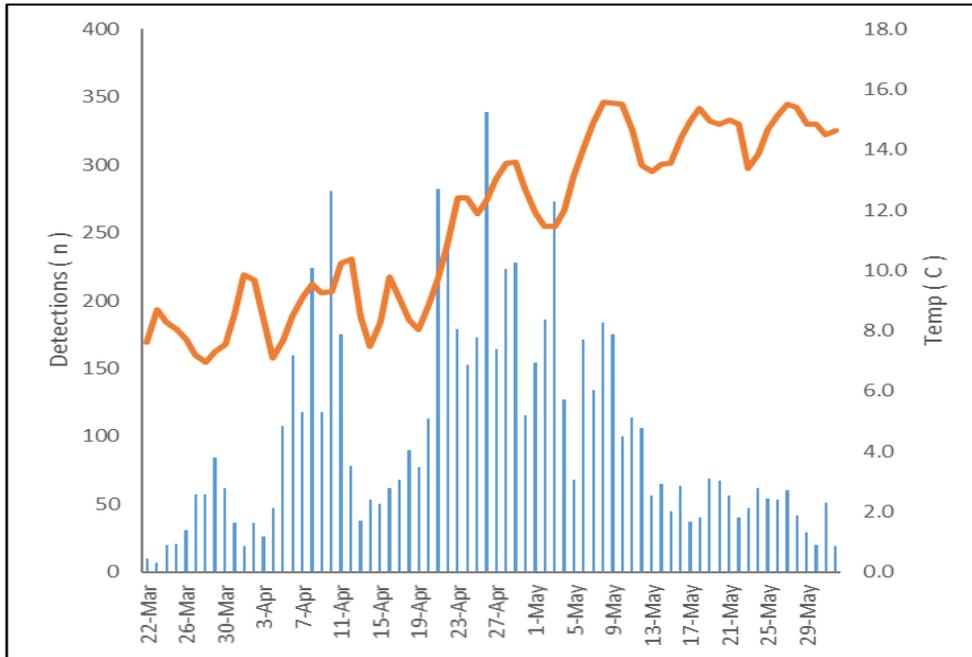


Figure 3. Number of individual or unique tags detected each day and mean daily stream temperature, USGS Green River at Jensen, UT gage, during the 2018 sampling season at Razorback Bar, UT.

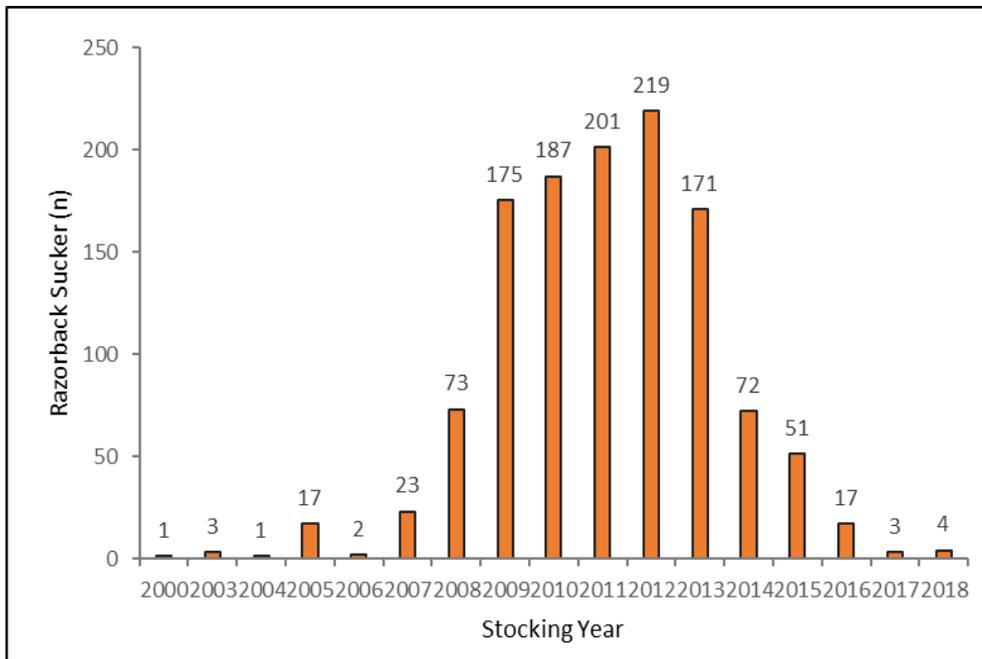


Figure 4. Year of stocking and number of unique detections for razorback sucker detected by Razorback Bar PIT tag antennas in 2018

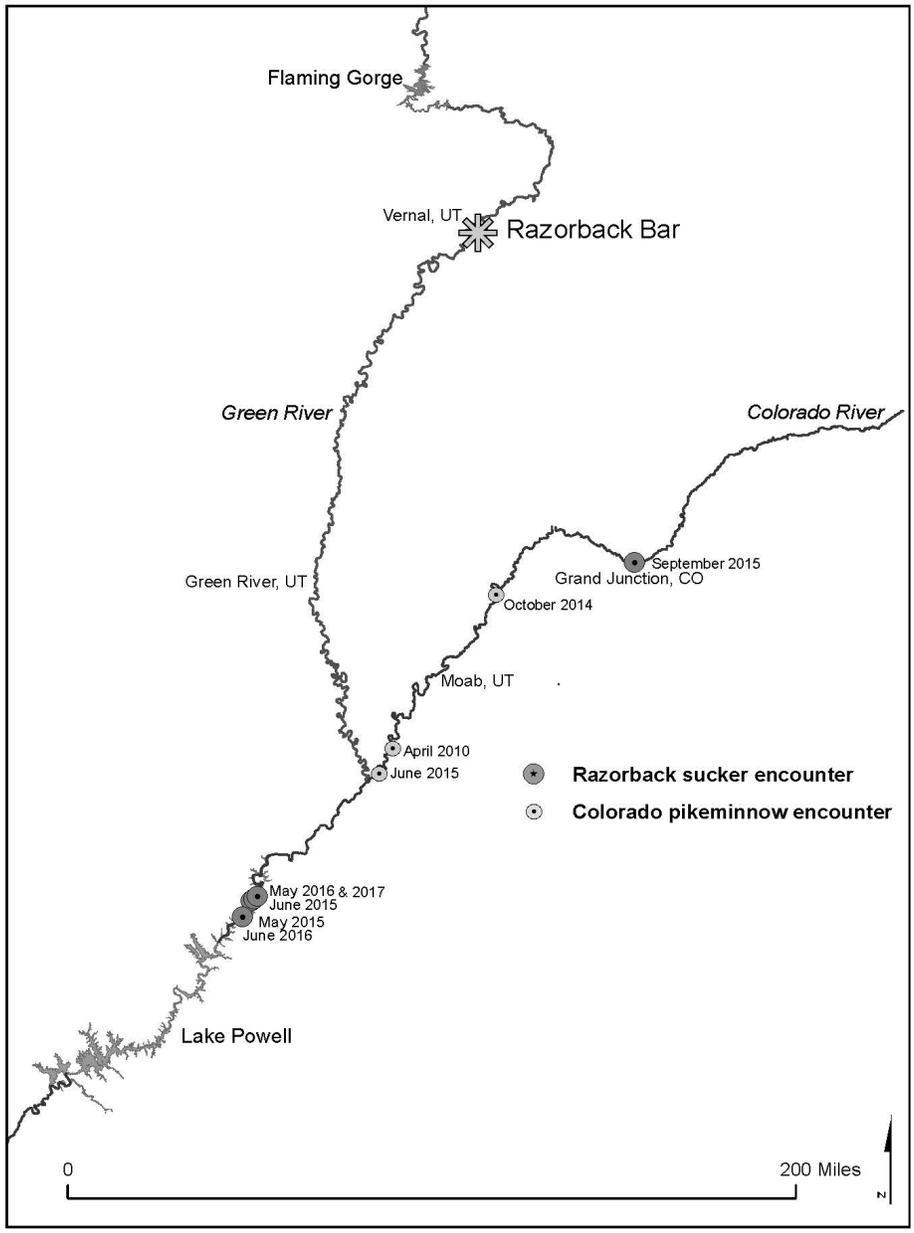


Figure 5. Colorado River and Lake Powell encounter locations and date of Colorado-pikeminnow and razorback sucker detected at Razorback Bar, UT in 2018.