

COLORADO RIVER RECOVERY PROGRAM  
FY 2019 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: 09/30/2019  
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 2019, the Green River Basin Fish and Wildlife Conservation Office 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 14,623 detections, we were able to identify 3,639 individual or unique tags. These unique tags represented 3,390 razorback sucker, 135 Colorado pikeminnow, 52 bonytail, 16 roundtail chub, 29 flannelmouth sucker, 8 bluehead sucker, and 9 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 2019 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

**Razorback Bar**

The Green River Basin Fish and Wildlife Conservation Office (GRB FWCO) deployed six stand alone or “submersible” antennas on 4 April at Razorback Bar on the Green River, where the majority of PIT tag detections in this study have occurred (Figure 2, Smith et al. 2015, Smith et al. 2016, Smith et al. 2017). Three more antennas borrowed from the Grand Junction FWCO were deployed on 15 April. All nine antennas were retrieved on 18 July. During this period we detected unique PIT tag codes associated with 3,389 razorback sucker, 55 Colorado pikeminnow, one roundtail chub, 23 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 2019 than in any year of this study. Three more antennas were set at Razorback Bar in 2019 than have been set in the past two years. The additional antennas provided 691 daily unique detections per antenna out of a total of 8,313. This metric can be explained as how many unique PIT tag detections are recorded by one antenna within one calendar day. When combining the entire array/all antennas, the number of unique detections increased beyond 100 detections per day beginning 19 April and decreased after 15 May (Figure 3). Most of the razorback sucker detected were stocked from 2008 to 2015 as 1+ year olds (Figure 4) and would presumably be sexually mature. The earliest stocking date of any fish detected was 6 April 2003. This stocking date was associated with eight razorback sucker. One of these fish had not been encountered since June 2008 when it was captured by Utah Department of Wildlife Resources Vernal (UDWRV) near Jensen, Utah (RM 299.2).

Razorback suckers previously detected at Razorback Bar that were detected again in 2019 include 327 in 2018, 466 individuals in 2017, 54 in 2016, 144 in 2015, 79 in 2014, 92 in 2013, and 12 in 2012. In total, 37 percent (N = 1,354) of the razorback sucker detected at Razorback Bar in 2019 were previously detected by antennas at this spawning location at least once since 2012. Assuming these fish were present at Razorback Bar to spawn in all years, this proportion suggests a higher level of iteroparity than what has been observed in this data in the past. 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 of razorback suckers detected in 2019 (76.2%) had not been captured since stocking, and 47.8 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 the last two years.

Ouray National Fish Hatchery (ONFH) Randlett Unit stocked 98.3 percent (N=3,333) of

the razorback suckers detected at Razorback Bar. An additional five razorbacks were stocked by the Grand Valley Unit of ONFH; four of these fish were stocked at Green River, Utah and one in the Gunnison River (RM 57.1) in 2013. A razorback sucker stocked at Split Mountain in May by the Vernal Middle School was detected three weeks later at Razorback Bar. This was the second post-stocking encounter with a fish raised in the Razorbacks in the Classroom program in Utah. A total of 48 fish (1.4%) that likely lost their hatchery tags were tagged by Utah Division of Wildlife Resources (Vernal and Moab) and GRB FWCO field crews. Five razorback suckers that were stocked in the White River at the Enron boat ramp in April 2018 were detected at Razorback Bar. Excluding these five fish and the individual stocked in the Gunnison River, all razorback suckers detected this year were stocked in the Green River between Rainbow Park and Green River, Utah.

For the fourth year in a row, razorback suckers that have ventured outside of the Green River Basin were observed at Razorback Bar. One razorback sucker previously encountered in the Colorado River, four in Lake Powell, and the previously mentioned individual that was stocked in the Gunnison River were detected in 2019 (Figure 5). Combined with the 17 individuals detected at this site from 2016 to 2018 that had previously been encountered in the Colorado River or Lake Powell, these detections hint at a more extensive exchange between razorback suckers 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](http://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.

### ***Colorado pikeminnow***

Fifty-four Colorado pikeminnow were detected at Razorback Bar in 2019 compared to 30 in 2018. Unlike razorback sucker, Colorado pikeminnow in the Upper Green River Basin are the result of reproduction in the wild, and fish are PIT-tagged by field crews when first encountered. Excluding six fish missing tag deployment records, the majority (N = 42) of Colorado pikeminnow detected at this site in 2019 were tagged in the Green River between RM 52.2.5 and RM 345. The six remaining traceable individuals were tagged in the Yampa River (n = 3) between RM 41.1 and RM 73.2, the White River at RM 8.7 and 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 2018 and reported in both years' Project 169 Annual Report (Figure 5; Smith et al. 2017, 2018).

### ***Bonytail***

Razorback Bar antennas detected tags from 49 bonytail, of which 27 fish were stocked at Rainbow Park (RM 329.5) in September 2018, 21 were stocked near Jensen, Utah (RM 303 and RM 294) in June 2019, and one individual was stocked in the Yampa River (RM 11.8) in August 2017. This constitutes more unique bonytail detections in a single year than in the previous four years combined (Smith et al. 2015, 2016, 2017, 2018) and more impressively, most of these fish successfully overwintered.

### ***Other species***

Razorback Bar PIT tag detections associated with other species include 23 flannelmouth sucker, five bluehead sucker, 8 flannelmouth x razorback sucker hybrids, and one roundtail chub (Table 1). All were PIT-tagged by UDWR Vernal except for the roundtail chub which was tagged by GRB FWCO in Split Mountain in 2017.

### **Spawning Bars on the Yampa River**

Using the same approach as Razorback Bar on the Green River, this project was expanded in 2015 to 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. The less obtrusive nature of the submersible antennas in comparison to other PIAs, which require more surface infrastructure (batteries, solar panels, etc.) to operate, allows 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 three submersible antennas were set at this location from 8 May to 19 July. Access to this site prior to Project 110 electrofishing passes entails a one-mile walk from the Echo Park road. Pack rafts were used to set two antennas off the right shore of the Yampa River in 2019.

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's listing under the Endangered Species Act in 1991 (Tyus and Karp 1990). In total, 81 identifiable unique tags were detected at Echo Park Bar in 2019, consisting of one razorback sucker, 58 Colorado pikeminnow, 3 bonytail, 9 roundtail chub, 6 flannelmouth sucker, 3 bluehead sucker, and one flannelmouth x razorback sucker hybrid (Table 2). While the original intent of monitoring this site with antennas was to detect razorback sucker, it has been proven more useful for Colorado pikeminnow monitoring.

Of the 58 Colorado pikeminnow detected at Echo Park Bar in 2018, 38 were PIT-tagged in the Green River (RM 36.1 – RM 353.1), eleven in the Yampa River (RM 0.2 – RM 20.8), one in Vermillion Creek, and one in the White River (RM 19.5). Deployment records do not exist in the STReaMS database for the seven remaining PIT tags. Fourteen of the 58 Colorado pikeminnow detected at Echo Park Bar in 2019 have not been captured since they were PIT-tagged, yet all of these fish had been detected by antennas prior to 2019. Additionally, six of the Colorado pikeminnow detected at Echo Park were detected later at Cleopatra's Couch in 2019.

Bonytail detected at Echo Park Bar in 2019 were stocked at Echo Park (Green River RM 344) on 11 August 2015 (n = 1) and Rainbow Park (RM 329.5) on 13 August 2018 (n = 2). Although bonytail detections at Echo Park were not numerous, all of these fish demonstrated overwinter survival, most notably the Echo Park-stocked individual.

The majority (n = 7) of the nine roundtail chub detected by Echo Park Bar antennas in 2019 were PIT-tagged within 16 river miles of this monitoring site. The two remaining fish include a chub that was tagged by Colorado Parks and Wildlife in the White River (RM 90.4) in 2016 and an individual that lacks tagging information.

### ***Cleopatra's Couch Bar***

Cleopatra's Couch Bar is located at Yampa River mile 16.5 and is one of two gravel bar complexes 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 19 June and retrieved on 19 July because of decreasing flows on the Yampa River. Deployment, data retrieval and maintenance of these antennas was conducted concurrently with Project 110 (Lower Yampa Nonnative Management). These 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 39 individual fish, which consisted of 32 Colorado pikeminnow and 7 roundtail chub (Table 3). Among the roundtail chub detected, five had been tagged in the Yampa River between RM 9.6 – RM 15.8 during Project 110 fish community monitoring passes, one was tagged on the Green River (RM 342.6) by the Colorado State University Larval Fish Lab (LFL) as part of Project FR-115, an another was tagged in the Green River in Echo Park (RM 344.3) during Project 123a passes.

Among the 28 fish with traceable tagging histories, the proportion of Colorado pikeminnow tagged in the Yampa River (RM 0.6 – 49.9) detected at Cleopatra's Couch Bar in 2019 (32% or nine individuals) was higher than that of 2018 (21% or six individuals); the majority in both years were tagged in the Green River (RM 30.8 – RM 366.5). There were also two fish that were PIT tagged in the White River (RM 1.8 and RM 19.2). Twenty-seven of the Colorado pikeminnow detected in 2019 were also

detected at this site between 2015 and 2018 and four individuals have been detected every year since 2015. Six Colorado pikeminnow were recorded at Echo Park Bar between three to seven 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 12 years for a fish tagged by UDWR Vernal in April 2007 at Green River RM 293.9.

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](http://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***

Although three antennas were deployed at Echo Park this year, only two were functioning throughout the sampling period because one antenna was buried under sand and not retrievable from 14 June to 19 July. An antenna was set at this location in 2018 and was never buried, however peak flows in the Yampa River were much higher for a longer duration in 2019 which presumably caused the burial.

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 2019 Budget Status

A. Funds Provided: \$29,237

B. Funds Expended: \$29,237

C. Difference: -0-

D. Percent of the FY 2019 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 15 October 2019.

XIII. Signed: Christian Smith 12/4/2019  
Principal Investigator Date

## Literature Cited

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- 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. 2015. 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.
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- 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 2019.

Species	Number of Unique Tags Detected
Razorback sucker	3,389
Colorado pikeminnow	54
Bonytail	49
Flannelmouth sucker	23
Flannelmouth x razorback sucker	8
Bluehead sucker	5
Roundtail chub	1
Total	3,530

Table 2. PIT tag antenna detections unique codes per species at Echo Park Bar, CO in 2019.

Species	Number of Unique Tags Detected
Colorado pikeminnow	58
Razorback sucker	1
Bonytail	3
Roundtail chub	9
Flannelmouth sucker	6
Bluehead sucker	3
Flannelmouth x razorback sucker	1
Total	81

Table 3. PIT tag antenna detections of unique codes per species at Cleopatra's Couch-Bar, CO in 2019.

Species	Number of Unique Tags Detected
Colorado pikeminnow	32
Roundtail chub	7
Total	39

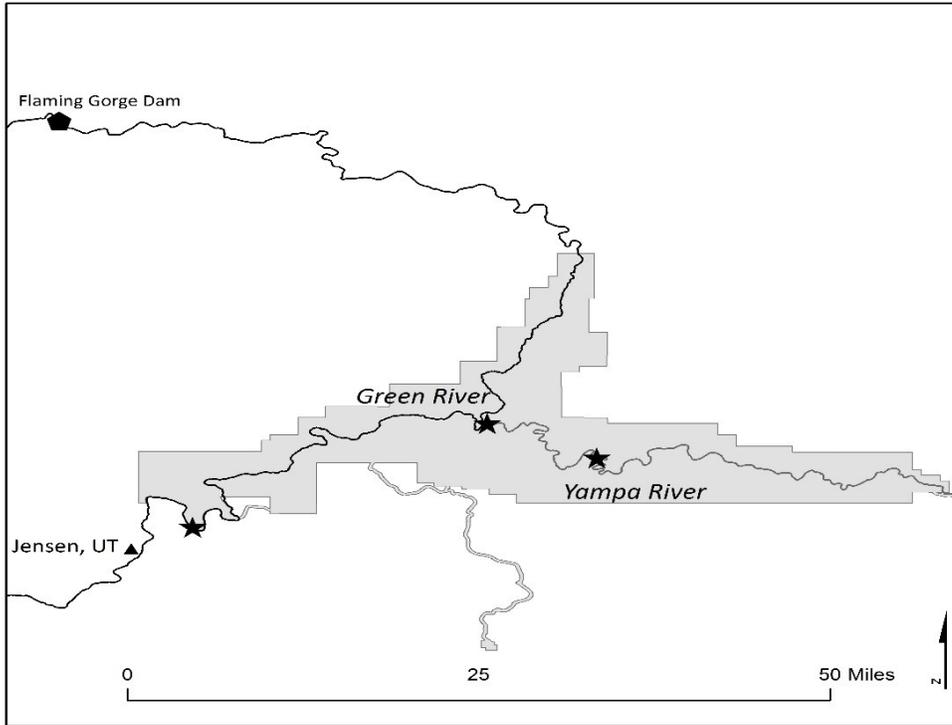


Figure 1. Locations of PIT tag antenna arrays set by Green River Basin FWCO in 2019 indicated by stars. The shaded polygon shows the extent of Dinosaur National Monument.

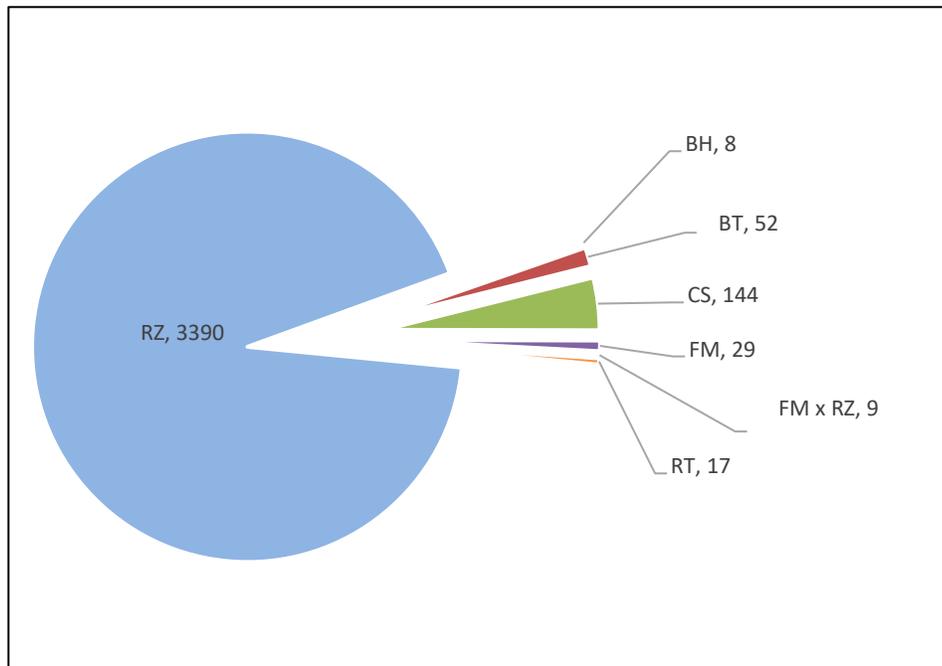


Figure 2. Relative proportion and number of PIT-tagged fish detected at Passive Interrogation Arrays (PIAs) set at Razorback Bar on the Green River, Echo Park Bar on the Yampa River, and Cleopatra's Couch Bar on the Yampa River in 2019.

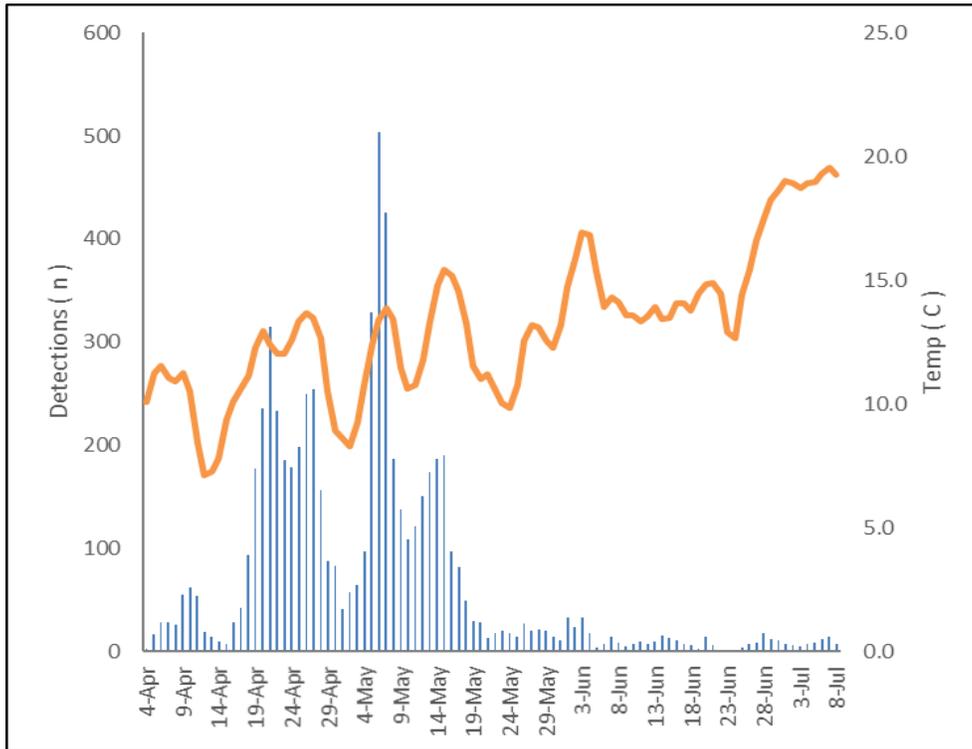


Figure 3. Number of individual or unique tags detected each day and mean daily stream temperature, USGS Green River at Jensen, UT gage, during the 2019 sampling season at Razorback Bar, UT.

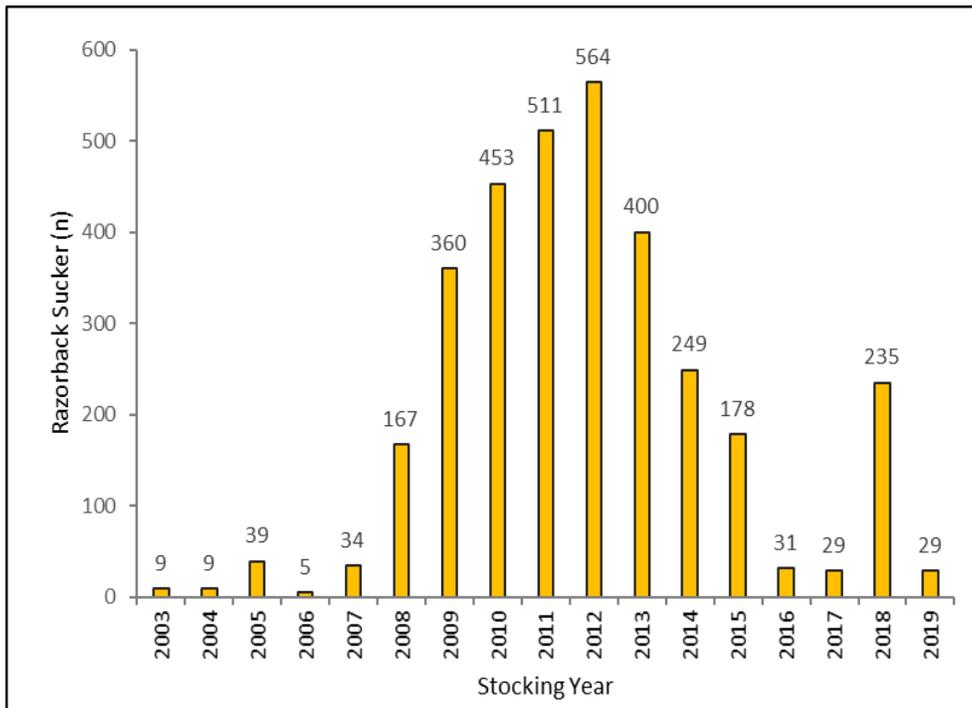


Figure 4. Year of stocking and number of unique detections for razorback sucker detected by Razorback Bar PIT tag antennas in 2019.

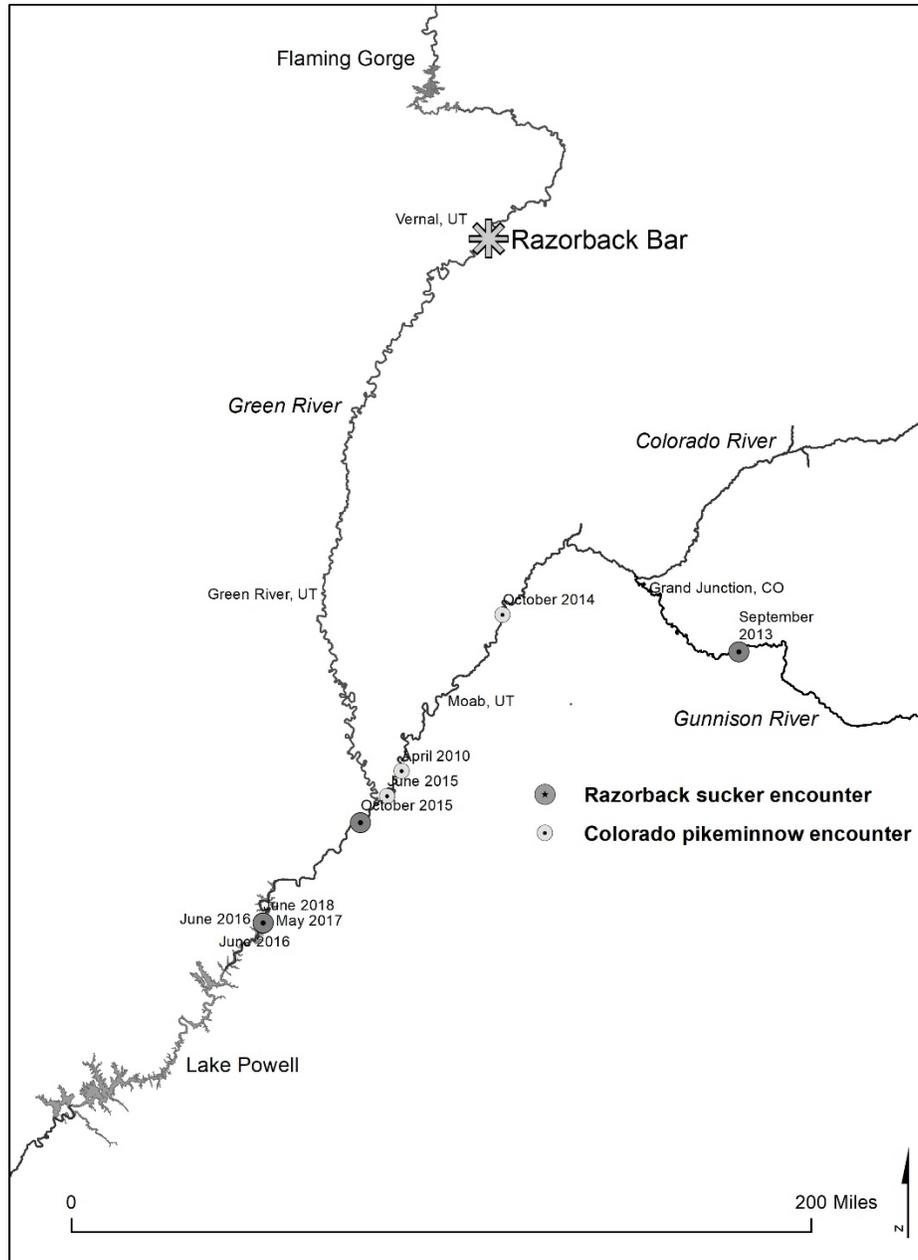


Figure 5. Colorado River, Gunnison River, and Lake Powell encounter locations and date of Colorado pikeminnow and razorback sucker detected at Razorback Bar, UT in 2019.