

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2022 ANNUAL REPORT

PROJECT: 169

Project Title

Monitoring Spawning Aggregations on the Green and Yampa Rivers with Antennas.

Bureau of Reclamation Agreement Number:

R20PG00024

Project/Grant Period:

Start date: 10/1/2019

End date: 9/30/2024

Reporting period end date: 9/30/2022

Is this the final report? Yes No

Principal Investigators:

Chris Smith, Supervisory Fish Biologist

Dave Beers, Fisheries Technician

U.S. Fish and Wildlife Service

Utah FAC Complex

Green River Basin Fish and Wildlife Conservation Office

1380 S. 2350 W.

Vernal, UT 84078

Phone: (435)789-0351

Fax: (435)789-4805

Email: christian_t_smith@fws.gov, dave_beers@fws.gov

Abstract:

Portable passive integrative transponder (PIT) tag antennas allow researchers to detect PIT-tagged fish in remote locations with minimal infrastructure, labor, or maintenance. Furthermore, data collected by antennas provides vital evidence of endangered fish survival and movement. The Green River Basin Fish and Wildlife Conservation Office deployed portable antennas at four known spawning locations in the Green and Yampa rivers in 2022 with the goal to detect as many tagged endangered Razorback Sucker, Colorado Pikeminnow, and Bonytail as possible. Out of 11,747 detections, we were able to identify 4,914 individual or unique tags. These unique tags represented 4,634 Razorback Sucker, 148 Colorado Pikeminnow, 29 Bonytail, 2 Humpback Chub, 8 Roundtail Chub, 63 Flannelmouth Sucker, 21 Bluehead Sucker, and 9 Flannelmouth x Razorback Sucker hybrids.

Study Schedule:

2012-Ongoing

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

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V.D.1. Implement Razorback Sucker monitoring plan.

Accomplishment of FY 2022 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Razorback Bar PIT tag antenna monitoring

The Green River Basin Fish and Wildlife Conservation Office (GRB FWCO) deployed eight stand-alone or “submersible” antennas on 1 April 2022 at Razorback Bar on the Green River, where the majority of passive integrated transponder (PIT) tag detections in this study have occurred (Figure 1, Smith et al. 2016-2018 and 2021, Smith and Beers 2019 and 2020). Most of the unique-daily detections (95.4%) were recorded by six of these antennas. We detected unique PIT-tag codes associated with 4,446 Razorback Sucker *Xyrauchen texanus*, 70 Colorado Pikeminnow *Ptychocheilus lucius*, 28 Bonytail *Gila elegans*, 24 Flannelmouth Sucker *Catostomus latipinnis*, 17 Bluehead Sucker *Catostomus discobolus*, 9 Flannelmouth x Razorback Sucker hybrid *Catostomus latipinnis x Xyrauchen texanus*, and 1 Roundtail Chub *Gila robusta* during this period in 12,614.2 hours of total effort (Table 1).

Razorback Sucker

More Razorback Sucker (RZ) were detected at Razorback Bar in 2022 than any year since this project’s inception. The number of unique detections per day exceeded 100 PIT-tag codes beginning 21 April and decreased after 13 May (Figure 2). A similar pattern was observed in 2019, which was the next most productive year of detections at Razorback Bar, when this threshold was exceeded between 19 April and 15 May (Figure 3 in Smith and Beers 2019).

Numerous RZ detected at Razorback Bar in past years were detected again in 2022 (Figure 3). Over one third (37.5%; N = 1,669) of the RZ detected at Razorback Bar in 2022 were previously detected by antennas at this known spawning location at least once since 2012. Webber and Beers (2014) found that the majority (93%) of RZ detected at Razorback Bar in 2012-2013 had not been previously captured during active river sampling. The majority (81.9 %) of RZ detected in 2022 had not been captured since stocking, and 48.2 percent had neither been captured nor previously detected by PIT tag antennas. The latter proportion decreased markedly from 73 percent in 2017. This decrease is possibly the effect of more extensive PIT tag antenna coverage at Razorback Bar and throughout the Green River Basin in the last five years.

The Ouray National Fish Hatchery (ONFH) – Randlett unit stocked 99.03 percent of the RZ detected at Razorback Bar in 2022. All of these fish were stocked into the Green River between Echo Park (RM 344.3) and Green River, Utah (RM 120.1). The ONFH Grand Valley unit stocked one of these RZ and the ONFH Randlett unit stocked the remainder. In addition, 43 RZ (0.97 percent) were tagged by Utah Division of Wildlife Resources (UDWR) Vernal and GRB FWCO field crews after being captured in the field, and are likely hatchery fish that lost their tags. Razorback Sucker stocked between 2017 and 2019 yielded more detections than other stocking cohorts and perhaps the oldest RZ detected was stocked in 2000 (Figure 4).

As of 2022, the detection of RZ that have ventured outside of the Green River Basin has occurred on antennas at Razorback Bar during six separate years. Five RZ were detected this year that have also

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been encountered in the Colorado River ($n=3$) or Lake Powell ($n=2$). Among those was one individual that was stocked at Ouray National Wildlife Refuge (ONWR; Green River RM 255.4) in 2011, captured in the lower Green River (RM 23.5) in 2016, detected in Lake Powell (Colorado RM -62.5) in 2017, detected at Razorback Bar (RM 309.5) in April 2018, detected at the Tusher Diversion Dam (RM 129.3) in October 2020, and finally detected at Razorback Bar (RM 312.8) in April 2022. This individual has travelled at least 1,056.6 river miles since stocking.

Colorado Pikeminnow

Seventy Colorado Pikeminnow (CPM) were detected at Razorback Bar in 2022 compared to 30 in 2021. Unlike most RZ, all CPM in the Upper Green River Basin are wild fish PIT-tagged by field crews. Other than two CPM that lack PIT-tag deployment records, the CPM detected at Razorback Bar this year were PIT-tagged between 2006 and 2022. The majority ($n = 55$) of CPM detected at this site in 2022 were tagged in the Green River (RM 14.2-RM 345). Seven of the remaining fish were PIT-tagged in the Yampa River (RM 8-RM 105), four in the White River (RM 8.7-RM 93.7), one in Vermillion Creek (Green RM 368.9) and the other at RM 19.1 in the Colorado River. The remaining two CPM lacked PIT tag deployment records. Four CPM detected at Razorback Bar were detected between 13 to 55 days later at Echo Park Bar. These four individuals may have been migrating upstream to spawn in the Yampa River.

Bonytail

Razorback Bar antennas detected tags from 28 Bonytail in 2022 compared to none in 2021. Twenty-seven of these fish were stocked by ONFH at Rainbow Park (Green River mile 329.5) on 12 August 2021 and the other individual was stocked at the ONFH (RM 261.8) on 26 August 2021.

Echo Park Bar PIT tag antenna monitoring

The spawning bar that we refer to as Echo Park Bar is located in the Yampa River, 0.3 miles upstream from the Green River confluence, and three submersible antennas were set at this location on 22 April and were retrieved on 30 June (2,322.6 hours of total effort). Unfortunately, one of the antennas was not reading tags throughout the sampling period. Outside of visiting this site via raft on Project 110 electrofishing passes, access entails a one-mile walk from the Echo Park road. When access was achieved by foot, pack rafts were used to deploy and maintain an antenna set off the north bank of the Yampa River. In total, 67 traceable unique tags were detected at Echo Park Bar in 2022, consisting of 52 CPM, 2 RZ, 4 Roundtail Chub, 7 Flannelmouth Sucker, and 2 Bluehead Sucker (Table 2).

Colorado Pikeminnow

Of the 52 CPM detected at Echo Park Bar in 2022, 36 were PIT-tagged in the Green River (RM 0–358), 10 in the Yampa River (RM 0.1-49.9), and 1 in the mouth of Vermillion Creek (Green RM 368.9). These fish were PIT-tagged between 1992 and 2021. Deployment records were not available for the five remaining PIT tag codes. Twenty-one of the 52 CPM detected at Echo Park Bar in 2022 have not been captured since they were PIT-tagged, yet only three of these fish had not been detected by antennas prior to 2022.

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Razorback Sucker

The Ouray National Fish Hatchery Randlett unit stocked the two RZ detected at Echo Park Bar in 2022. These fish were stocked in the Green River at Ouray NWR (RM 255.4 and RM 298.3) in 2012 and 2018, respectively. Although rare, the majority of RZ 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 RZ's federal listing under the Endangered Species Act in 1991 (Tyus and Karp 1990).

Roundtail Chub

The four Roundtail Chub detected at Echo Park this year were PIT-tagged within 15 river miles of the 2022 array. Three of these fish had not been captured since they were PIT-tagged in 2009 ($n=1$) or 2010 ($n=2$) yet have been detected by antennas at this site in multiple years.

Cleopatra's Couch Bar PIT tag antenna monitoring

Cleopatra's Couch Bar is located on the Yampa River, 16.5 river miles upstream of the Green River confluence, and is one of two gravel bar complexes in the Green River Basin that have been extensively documented as CPM spawning locations (Tyus and McAda 1984, Tyus 1990, Irving and Modde 2000).

Three submersible antennas were deployed at or near this spawning bar on 15 June 2022 and retrieved on 30 June 2022 (1,045.9 hours of total effort) because of dropping flows on the Yampa River. Most of the 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 CPM at this spawning bar that otherwise would not have occurred because GRB FWCO field crews do not electrofish this reach due to the potential for spawning disruption.

We were able to locate tag information for 19 fishes, which consisted of 16 CPM and 3 Roundtail Chub (Table 3).

Colorado Pikeminnow

The majority (68.7%, $n = 11$) of the 15 CPM with tag deployment records detected at Cleopatra's Couch in 2022 were first encountered and PIT-tagged in the Green River (RM 45.3 - 345), and 4 individuals were tagged in the Yampa River (RM 5.0 – 45.3). Thirteen of the CPM detected this year were also detected at this site between 2015 and 2021, one individual had been detected in 5 different years, and 2 individuals were detected in 3 separate years. Also among the CPM detected at Cleopatra's Couch this year were two fish that were recorded at Razorback Bar in 2022. Five of the 16 CPM detected at Cleopatra's Couch Bar were also detected at Echo Park Bar in 2022. The maximum time at large without capture for a CPM detected at Cleopatra's Couch in 2022 was over 9 years for a fish that was last caught at Yampa RM 38.4 on 11 June 2013.

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Roundtail Chub

Among the 3 Roundtail Chub detected at Cleopatra's Couch this year, 2 had been tagged in the Yampa River in 2014 (RM 32) and 2020 (RM 17) during Project 110 passes. The other fish was tagged in 2012 on the Green River (RM 344.3) by UDWR Moab.

Three Fords PIT tag antenna monitoring

Similar to Cleopatra's Couch on the Yampa River, early researchers noted a high amount of CPM spawning activity at the Three Fords area in Gray Canyon of the Green River while conducting movement studies via radio telemetry (Tyus 1990, Irving and Modde 2000). Using the same strategy as at Razorback Bar, Echo Bar, and Cleopatra's Couch, wherein monitoring occurs at known spawning locations, we set four portable PIT tag antennas near Three Fords during Project 128 passes this year. The Bureau of Land Management's Desolation Canyon river rangers and the Ute Indian Tribe Fish and Wildlife Department maintained and/or retrieved these antennas after we completed the final Project 128 pass in late May, thereby making this initial investigation possible.

The Three Fords antennas detected 233 PIT tags between 22 April 2022 and 22 July 2022 (6,129.8 hours of total effort). These tags were associated with 10 CPM, 186 RZ, 1 Bonytail, 2 Humpback Chub, 32 Flannelmouth Sucker, and 2 Bluehead Sucker (Table 4).

Colorado Pikeminnow

All of the CPM detected at Three Fords were initially encountered and PIT-tagged in the Green River (RM 4.4 – 226.3) between May 2016 and May 2022. Two of these fish were captured during Project 128 passes in 2022 and only two have been captured since they were PIT-tagged. In addition, most (n=8) of these CPM were detected after the completion of Project 128, which precludes their use in closed-population abundance estimation (Zelasko and Bestgen 2022).

Razorback Sucker

Of the 182 RZ detected at Three Fords with traceable stocking records, all but one were stocked in the Green River (RM 120.1-345) by ONFH between 2005 and 2021; the other individual was stocked at the Enron boat ramp on the White River (RM 24) by ONFH in April 2018. Prior to 2022, 29 (15.6%) of these RZ had been captured since stocking and 34 (18.3%) had been detected by PIT tag antennas in the Green River including those at the Tusher Diversion Dam and Razorback Bar.

Shortcomings

Some PIT tag antennas were not functioning upon arrival during multiple downloading visits in 2022. This was the result of extending maintenance intervals beyond two weeks on a few occasions. However, we also found dead batteries during weekly visits. While our older batteries will be replaced this winter, it appears that at least two of our antennas were not working during multiple visits. We plan on testing these antennas this winter and will send them to the manufacturer if necessary.

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Although reduced since the earliest years of this project, PIT tag codes lacking some or all tagging information exist. Although we were able to determine species and encounter histories for the vast majority of codes detected, 304 PIT tag codes or 5.8 percent of the codes detected by our antennas in 2022 do not currently contain information within the STReAMS database.

Since relatively few (4.6%) detections were recorded by two of the Razorback Bar antennas, we would like to consider deploying these antennas elsewhere. Detection data collected by PIT tag antennas can improve survival and abundance estimate precision, especially if antenna coverage in the middle Green River is more widely distributed (Zelasko and Bestgen 2022). While this project has provided important information pertaining to the survival of stocked RZ, the vast majority of detections have occurred only at Razorback Bar.

Recommendations:

1. 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.
2. 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 if detections overlap the physical sampling period.
3. Move some antennas to managed wetland connection canals. The Green River Basin FWCO currently has 16 portable or submersible PIT-tag antennas on station. Given that some antenna locations at Razorback Bar have not produced many detections over many years, some antennas should be deployed near managed wetland connection canals to allow for the detection of the thousands of wild origin RZ that were PIT-tagged and released into the Green River in 2022, which has been identified as a priority by the Program Director's Office and Biology Committee.
4. Use pack rafts to deploy, maintain, and/or retrieve PIT-tag antennas from Cleopatra's Couch when access via Project 110 passes is not possible.
5. 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.

Project Status:

On track and ongoing.

FY 2022 Budget Status

Funds Provided: \$30,014

Funds Expended: \$30,014

Difference: \$0

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Percent of the FY 2022 work completed, and projected costs to complete: 100%, \$0
Recovery Program funds spent for publication charges: \$0

Status of Data Submission

Data was submitted to the STReAMS database manager on 11/16/2022

Science/Technical Reviewer:

Andrew A. Schultz Ph.D., USFWS, Utah FAC Complex Manager / Project Leader
andrew_schultz@fws.gov

Signed:

Chris Smith
Dave Beers
20 December 2022

References

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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.

Tyus, H.M. and C.W. McAda. 1984. Migration, movements, and habitat preferences of Colorado squawfish, *Ptychocheilus lucius*, in the Green, White, and Yampa rivers, Colorado and Utah. Southwestern Naturalist, 29: 289-299.

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.

Zelasko, K. A., and K. R. Bestgen. 2022. Obstacles to abundance estimation for razorback suckers *Xyrauchen texanus* in the Green River, 2016–2018. Final report to the Upper Colorado River Endangered Fish Recovery Program. Denver, Colorado. Larval Fish Laboratory Contribution 229.

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Table 1. PIT tag antenna detections of unique codes per species at Razorback Bar, UT in 2022.

| <u>Species</u> | <u>Number of Unique Tags Detected</u> |
|---------------------------------|---------------------------------------|
| Razorback Sucker | 4,446 |
| Colorado Pikeminnow | 70 |
| Bonytail | 28 |
| Flannelmouth x Razorback Sucker | 9 |
| Flannelmouth Sucker | 24 |
| Bluehead Sucker | 17 |
| Roundtail Chub | 1 |
| Total | 4,595 |

Table 2. PIT tag antenna detections of unique codes per species at Echo Park Bar, CO in 2022.

| <u>Species</u> | <u>Number of Unique Tags Detected</u> |
|---------------------|---------------------------------------|
| Colorado Pikeminnow | 52 |
| Razorback Sucker | 2 |
| Roundtail Chub | 4 |
| Flannelmouth Sucker | 7 |
| Bluehead Sucker | 2 |
| Total | 67 |

Table 3. PIT tag antenna detections of unique codes per species at Cleopatra's Couch Bar, CO in 2022.

| <u>Species</u> | <u>Number of Unique Tags Detected</u> |
|---------------------|---------------------------------------|
| Colorado Pikeminnow | 16 |
| Roundtail Chub | 3 |
| Total | 19 |

Table 4. PIT tag antenna detections of unique codes per species at Three Fords, UT in 2022.

| <u>Species</u> | <u>Number of Unique Tags Detected</u> |
|---------------------|---------------------------------------|
| Colorado Pikeminnow | 10 |
| Razorback Sucker | 186 |
| Bonytail | 1 |
| Humpback Chub | 2 |
| Roundtail Chub | 0 |
| Flannelmouth Sucker | 32 |
| Bluehead Sucker | 2 |
| Total | 233 |

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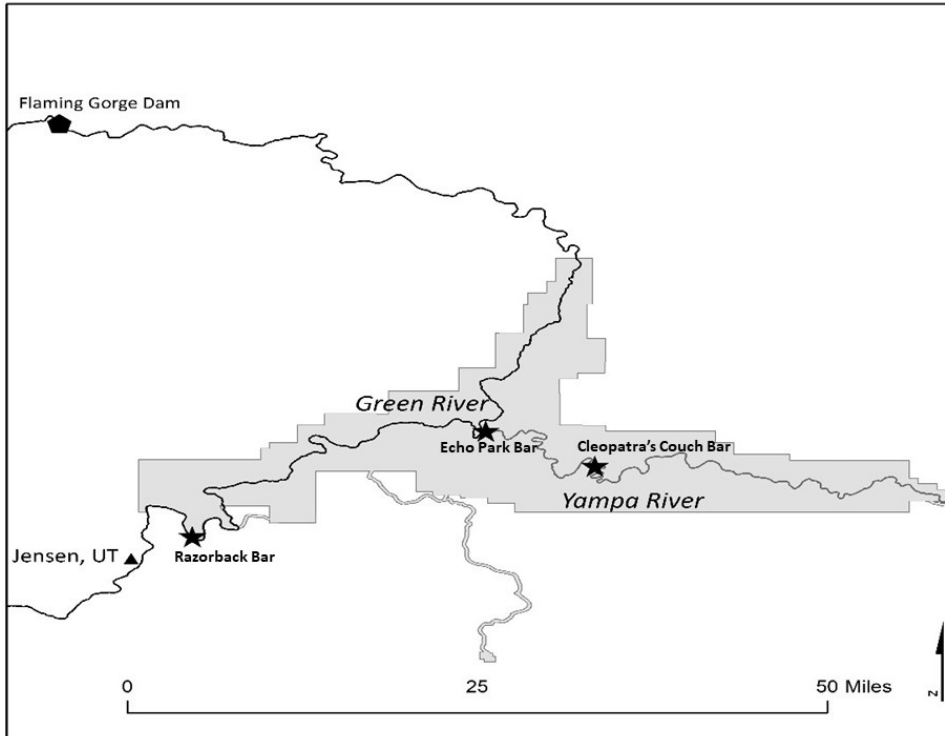


Figure 1. Locations of PIT tag antenna arrays set by Green River Basin FWCO in Dinosaur National-Monument in 2022 are indicated by stars. The shaded polygon shows the extent of Dinosaur National-Monument.

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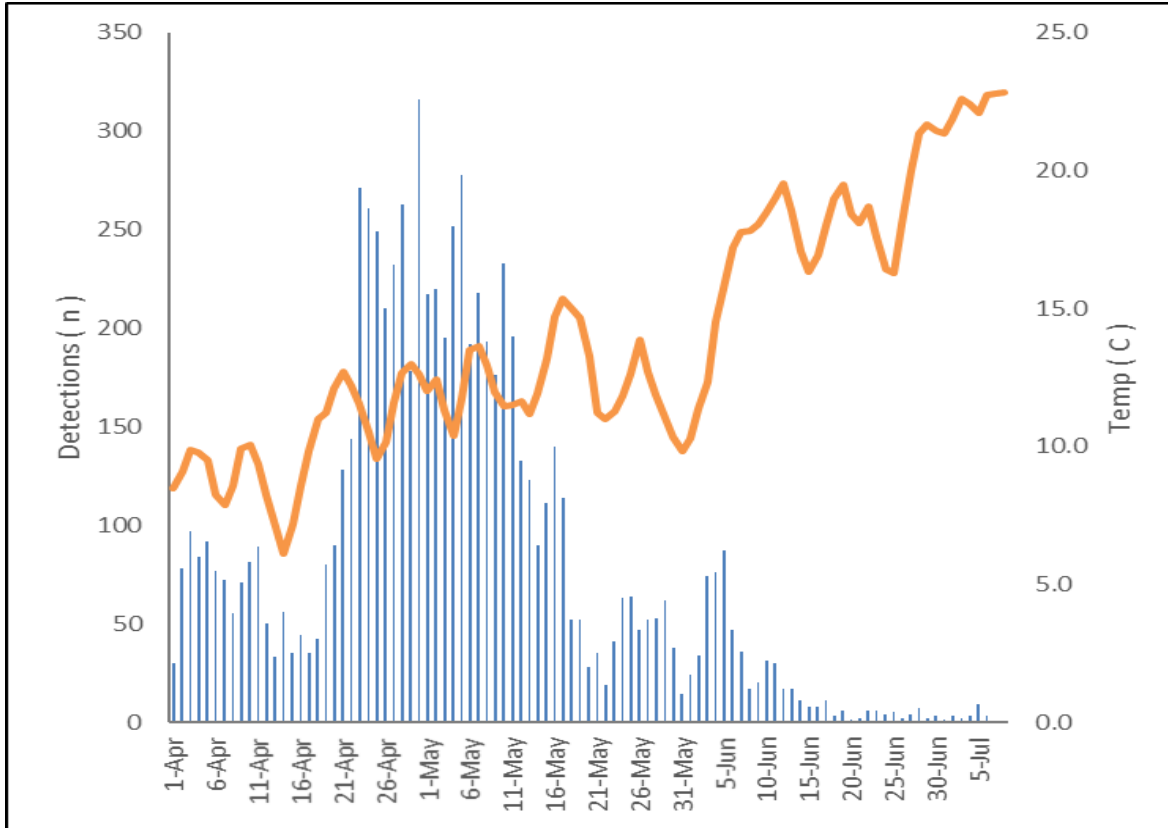


Figure 2. Number of individual or unique Razorback Sucker PIT tags detected each day (blue bars) and daily mean temperature (orange line; USGS gauge 09261000, located near Jensen, UT) during the 2022 sampling season at Razorback Bar, UT

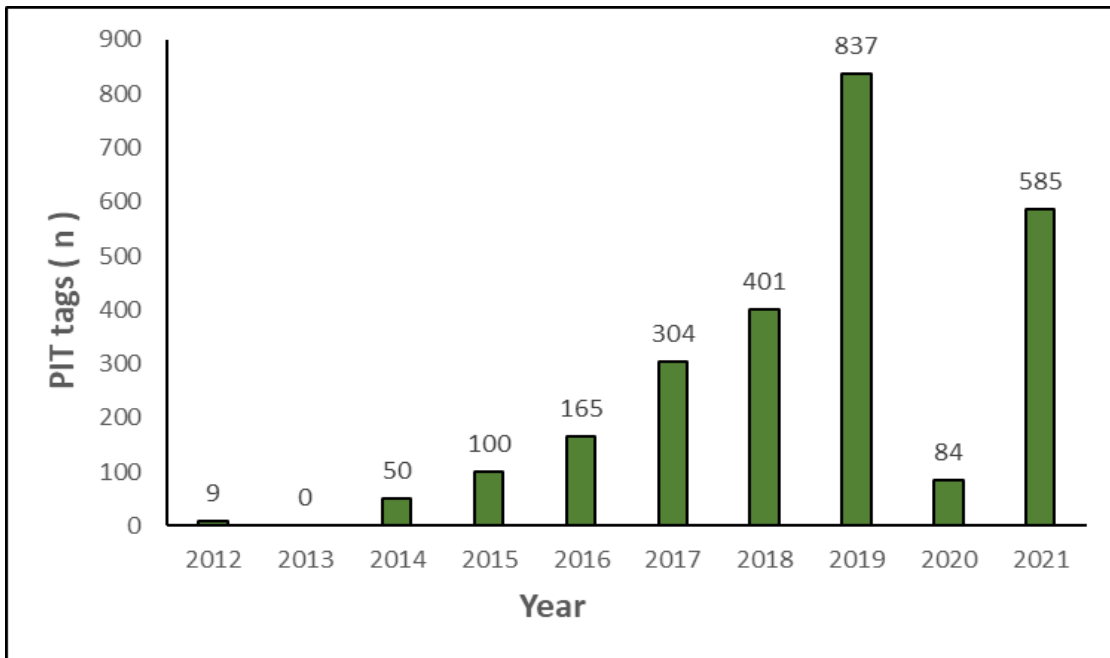


Figure 3. Number of Razorback Sucker PIT tags detected at Razorback Bar in 2022 that have been detected at this site in other years.

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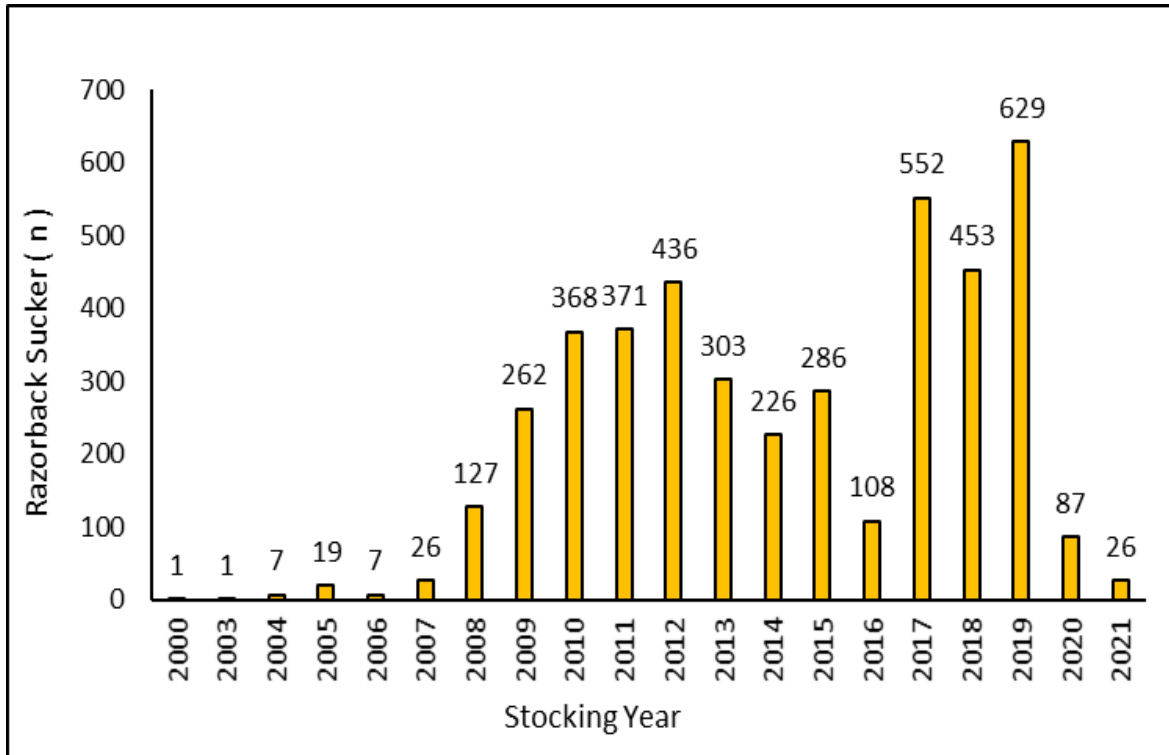


Figure 4. Stocking year and number of unique detections for Razorback Sucker detected by Razorback Bar PIT tag antennas in 2022. Incomplete stocking records reduced the number of unique PIT tag codes from 4,446 to 4,295 in this figure.