

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2021 ANNUAL REPORT

PROJECT: 169

Project Title

Detecting endangered fishes using PIT tag antenna technology in the Upper Colorado River Basin

Bureau of Reclamation Agreement Number:

R20PG00024

Project/Grant Period:

Start date: 10/1/2019

End date: 9/30/2024

Reporting period end date: 9/30/2021

Is this the final report? Yes No

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Abstract:

Portable PIT tag antennas allow researchers to detect PIT-tagged fish in remote locations with minimal infrastructure, labor, or maintenance. During 2021, 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 with the intention of detecting as many endangered Razorback Sucker, Colorado Pikeminnow, and Bonytail as possible. Out of 20,014 detections, we were able to identify 2,226 individual or unique tags. These unique tags represented 1,842 Razorback Sucker, 176 Colorado Pikeminnow, 2 Humpback Chub, 9 Roundtail Chub, 30 Flannelmouth Sucker, 8 Bluehead Sucker, one Flannelmouth x Razorback Sucker hybrid, and one fish displaying Humpback Chub and Roundtail Chub characteristics.

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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

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

Accomplishment of FY 2021 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 six stand-alone or “submersible” antennas on 8 April 2021 at Razorback Bar on the Green River, where the majority of PIT tag detections in this study have occurred (Figure 1, Smith et al. 2015-2018, Smith and Beers 2019 and 2020). During this period, we detected unique passive integrated transponder (PIT) tag codes associated with 1,831 Razorback Sucker *Xyrauchen texanus*, 30 Colorado Pikeminnow *Ptychocheilus lucius*, 6 Flannelmouth Sucker *Catostomus latipinnis*, two Flannelmouth x Razorback Sucker hybrid *Catostomus latipinnis x Xyrauchen texanus*, and one Humpback Chub *Gila cypha* (7,864.5 hrs of total effort; Table 1).

Razorback Sucker

More Razorback Sucker were detected at Razorback Bar in 2021 than in 2020, which is at least somewhat attributable to COVID-19 fieldwork restrictions delaying the initiation of 2020 sampling until late May. Nonetheless, more Razorback Sucker were detected in 2021 than in any year since this project’s inception except 2019. The number of unique detections per day exceeded 100 PIT-tag codes beginning 1 May and decreased after 9 May (Figure 2), whereas in 2019 this threshold was exceeded between 19 April and 15 May (Smith and Beers 2019; Figure 3). This could be explained by differences in hydrology, with 2021 being a much drier year than 2019. However, two of our antenna batteries were not holding charges, so comparison between these years should be viewed with caution.

Numerous Razorback Suckers detected at Razorback Bar in past years were detected again in 2021 (Figure 3). In total, 47.5 percent (N = 870) of the Razorback Sucker detected at Razorback Bar in 2021 were previously detected by antennas at this known spawning location at least once since 2012. Webber and Beers (2014) found that the majority (4%) of Razorback Sucker detected at Razorback Bar in 2012-2013 had not been previously captured during active river sampling. The majority, or 76.8 percent, of Razorback Suckers detected in 2020 had not been captured since stocking, and 36.6 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 four years.

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The Ouray National Fish Hatchery (ONFH) stocked 98.1 percent ($n = 1,748$) of the Razorback Suckers detected at Razorback Bar, and all of these fish were stocked in the Green River between Rainbow Park and Green River, Utah. A total of 30 fish (1.6 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. The remaining four individuals lacked stocking records. Razorback Sucker stocked between 2010 and 2012 yielded more detections than other stocking cohorts, which could be related to the reduction of ONFH stocking quotas since 2013 (Bestgen et al. 2020: Figure 1b). The earliest stocking record and perhaps oldest Razorback Sucker detected was from 1998 (Figure 4).

As of 2021, the detection of Razorback Suckers that have ventured outside of the Green River Basin has occurred on antennas at Razorback Bar during five separate years. Six Razorback Suckers were detected this year that have also been encountered in the Colorado River ($n=2$) or Lake Powell ($n=4$; Figure 5). Among those was one individual that was stocked at Ouray National Wildlife Refuge (NWR; RM 255.4) in 2012, captured in Lake Powell (Colorado RM -70.5) in 2016, detected at Razorback Bar (RM 311.1) in April 2018, detected at the Tusher Diversion Dam (RM 129.3) in August 2018, and finally detected at Razorback Bar (RM 312.8) in May 2021. Since stocking, this individual has travelled at least 1,072.8 river miles.

Colorado Pikeminnow

Thirty Colorado Pikeminnow were detected at Razorback Bar in 2021 compared to 27 in 2020. Unlike most Razorback Sucker, all Colorado Pikeminnow in the Upper Green River Basin are reared in the wild and PIT-tagged by field crews. The majority ($n = 28$) of Colorado Pikeminnow detected at this site in 2021 were tagged in the Green River between RM 38.5 and RM 358. Of the two fish remaining, one was PIT-tagged at RM 42.2 in the Yampa River, and the other at RM 19.1 in the Colorado River. Perhaps migrating upstream to spawn in the Yampa River, four Colorado Pikeminnow detected at Razorback Bar were detected between 5 to 54 days later at Echo Park Bar.

Bonytail

Razorback Bar antennas did not detect any Bonytail tags in 2021.

Humpback Chub

One Humpback Chub was detected (Table 1) at Razorback Bar. This is the second Humpback Chub detected in this project; the first was detected at Cleopatra's Couch in 2015. Unlike the previously detected Humpback Chub which had been PIT-tagged in Whirlpool Canyon (RM 338.1) by UDWR Moab in Dinosaur National Monument, this fish was initially caught and tagged by UDWR Moab in Desolation Canyon (RM 160.5) in 2019. The minimum distance this Humpback Chub traveled between these encounters is 152.3 river miles, which seems somewhat unusual for this species.

Other Fishes

Other fishes detected included, 1 Flannelmouth Sucker and 2 Flannelmouth Sucker x Razorback Sucker hybrids (Table 1).

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Echo Park PIT tag antenna monitoring

The spawning bar that we refer to as Echo Park Bar is located 0.3 miles upstream from the Green-Yampa River confluence, and four submersible antennas were set at this location on 22 April. Two of these antennas operated until 22 July (5,914.7 hrs of total effort). 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 two antennas set off the right bank of the Yampa River.

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 Federal listing under the Endangered Species Act in 1991 (Tyus and Karp 1990). In total, 159 identifiable unique tags were detected at Echo Park Bar in 2021, consisting of 104 Colorado Pikeminnow, 10 Razorback Sucker, 9 Roundtail Chub, one chub exhibiting characteristics of both Humpback and Roundtail Chub, 24 Flannelmouth Sucker, 8 Bluehead Sucker, and 3 Flannelmouth Sucker x Razorback Sucker hybrids (Table 2). More Colorado Pikeminnow were detected at Echo Park Bar in 2021 than in any other year at all monitoring locations. In addition, more Razorback Sucker were detected at this site than in any other year.

Colorado Pikeminnow

Of the 104 Colorado Pikeminnow detected at Echo Park Bar in 2021, 73 were PIT-tagged in the Green River (RM 30.8–366.5), 16 in the Yampa River (RM 5.0-49.9), 3 in the White River (RM 0.8-28.8), and 4 in the mouth of Vermillion Creek (Green RM 368.9). Deployment records were not available for the 8 remaining PIT tags. Forty-six of the 106 Colorado Pikeminnow detected at Echo Park Bar in 2021 have not been captured since they were PIT-tagged, and 10 of these fish had not been detected by antennas prior to 2021.

Razorback Sucker

Ouray National Fish Hatchery stocked all Razorback Suckers detected at Echo Park Bar in 2021. These fish were stocked in the Green River at Ouray NWR ($n = 8$; RM 255.4 and RM 261.8) or Green River, Utah ($n = 2$; RM 120.1) between 2008 and 2019.

Roundtail Chub

Among the Roundtail Chub detected at Echo Park this year, the majority or 8 fish were PIT-tagged within 15 river miles of the 2021 array. The exceptions were one Roundtail Chub that was PIT-tagged at river mile 90.4 in the White River and another at Rainbow Park on the Green River (RM 322.2). Three of these fish had been captured since tagging, and seven had previously been detected by PIT tag antennas in the Yampa River.

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Cleopatra's Couch Bar

Cleopatra's Couch Bar is located 16.5 river miles upstream of the Green River confluence and is one of two gravel bar complexes in the Upper Green River Basin that have been extensively documented as Colorado Pikeminnow spawning locations (Tyus and McAda 1984, Tyus 1990, Irving and Modde 2000). Three submersible antennas were deployed at or near this spawning bar on 27 May and retrieved on 1 July (2,529.3 hrs 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 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 tag information for 60 individual fish, which consisted of 42 Colorado Pikeminnow, 1 Humpback Chub, 1 Razorback Sucker, and 16 Roundtail Chub (Table 3). The majority (78.4%, $n = 29$) of the 37 Colorado Pikeminnow with tag deployment records were first encountered and PIT-tagged in the Green River (RM 45.3 - 347.1), and five individuals were tagged in the Yampa River (RM 9.8 – 35.5). There were also 2 fish that were PIT-tagged in the White River (RM 17.2 and RM 19.2) and 2 in the mouth of Vermillion Creek (Green RM 368.9).

Colorado Pikeminnow

Twenty-two of the Colorado Pikeminnow detected in 2021 were also detected at this site between 2015 and 2020, 1 individual had been detected 4 different years, and 5 fish's PIT-tags were recorded in 3 separate years. Among the Colorado Pikeminnow detected at Cleopatra's Couch this year were two fish that were also recorded at Razorback Bar in 2021. Curiously, none of the 104 Colorado Pikeminnow detected at Echo Park Bar, which is located between Cleopatra's Couch and Razorback Bar, were detected at Cleopatra's Couch in 2021. The maximum time at large without capture for a Colorado Pikeminnow detected at Cleopatra's Couch in 2021 was 13 years for a fish tagged by GRB FWCO in April 2008 at Green River RM 138.1.

Razorback Sucker

Razorback Sucker detections are infrequent at Cleopatra's Couch. Only three unique Razorback Sucker PIT tags have been detected at this site since monitoring began here in 2015, with the last detection occurring in 2016. The lone Razorback Sucker detected at Cleopatra's Couch in 2021 was stocked by ONFH in the Green River at Ouray NWR (RM 255.4) in 2011 and detected by antennas at Razorback Bar in 2019.

Humpback Chub

Humpback Chub detections at Cleopatra's Couch are yet again less frequent than Razorback Sucker detections. Prior to 2021, there had only been one Humpback Chub detected by antennas in this project until another was detected at Razorback Bar this year. The initial Humpback Chub detection occurred at Cleopatra's Couch in 2015, and the same individual's tag was detected at this site again in 2021. This fish was initially tagged in Whirlpool Canyon (RM 338.1) by UDWR Moab in 2007.

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Roundtail Chub

Among the Roundtail Chub detected at Cleopatra's Couch, 13 had been tagged in the Yampa River between RM 0.0 – RM 39.3 during Project 110 fish community monitoring passes. An additional Roundtail Chub was tagged on the Green River (RM 342.0) by the Colorado State University Larval Fish Lab (LFL), and the remaining two were tagged by GRB FWCO in lower Whirlpool Canyon (Green River RM 337.2 and 336.4).

Shortcomings

PIT tag antenna batteries were depleted upon arrival during multiple downloading visits in 2021. This was the result of extending maintenance intervals beyond two weeks on a few occasions. However, we also found dead batteries during weekly visits. Since it appears that some of our batteries are aging, it would be prudent to replace older batteries prior to the 2022 sampling season. If necessary, shortening maintenance intervals to a weekly schedule could be warranted.

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, 153 PIT tag codes or 6.8 percent of the codes detected by our antennas in 2021 do not currently contain information within the STReAMS database.

Additional noteworthy observations:

Bonytail were not detected by any PIT tag antennas in this project in 2021. Although Bonytail detections have never comprised a large proportion of overall detections in this project, this is somewhat concerning because we have stocked over 97,000 Bonytail in the Green River since this project's inception in 2014 (determined via 19 November 2021 STReAMS Encounter query). In addition, we have documented survival, including overwinter survival, of individual Bonytail with these antennas in other years.

Instead of pulling the Cleopatra's Couch antennas on the final Project 110 pass, with the permission of Dinosaur National Monument, we used pack rafts to retrieve them two weeks later, thereby extending the monitoring period. The pack rafts not only allowed us to run the Yampa River when flows were too low for rafts, but also access Cleopatra's Couch as a one-day trip from our office in Vernal, Utah.

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.

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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 access to Cleopatra's Couch via Project 110 passes is not possible, use pack rafts to deploy, maintain, and/or retrieve PIT-tag antennas from this site.

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 2021 Budget Status

Funds Provided: \$33,642

Funds Expended: \$33,642

Difference: \$0

Percent of the FY 2021 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 10/27/2021

Signed:

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16 November 2021

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19 November 2021

Dave Beers

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19 November 2021

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References

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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.

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Table 1. PIT tag antenna detections of unique codes per species at Razorback Bar, UT in 2021.

Species	Number of Unique Tags Detected
Razorback Sucker	1,831
Colorado Pikeminnow	30
Humpback Chub	1
Flannelmouth x Razorback Sucker	2
Flannelmouth Sucker	1
Roundtail Chub	0
Total	1,866

Table 2. PIT tag antenna detections unique codes per species at Echo Park Bar, CO in 2021.

Species	Number of Unique Tags Detected
Colorado Pikeminnow	104
Razorback Sucker	10
Flannelmouth x Razorback Sucker	3
Humpback x Roundtail Chub hybrid?*	1
Roundtail Chub	9
Flannelmouth Sucker	24
Bluehead Sucker	8
Total	159

* <https://streamsystem.org/viewEdit/encounterEdit.php?encounterID=662871>

Table 3. PIT tag antenna detections of unique codes per species at Cleopatra's Couch Bar, CO in 2021.

Species	Number of Unique Tags Detected
Colorado Pikeminnow	42
Razorback Sucker	1
Humpback Chub	1
Roundtail Chub	16
Total	60

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Figure 1. Locations of PIT tag antenna arrays set by Green River Basin FWCO in 2021 are indicated by stars. The shaded polygon shows the extent of Dinosaur National Monument.

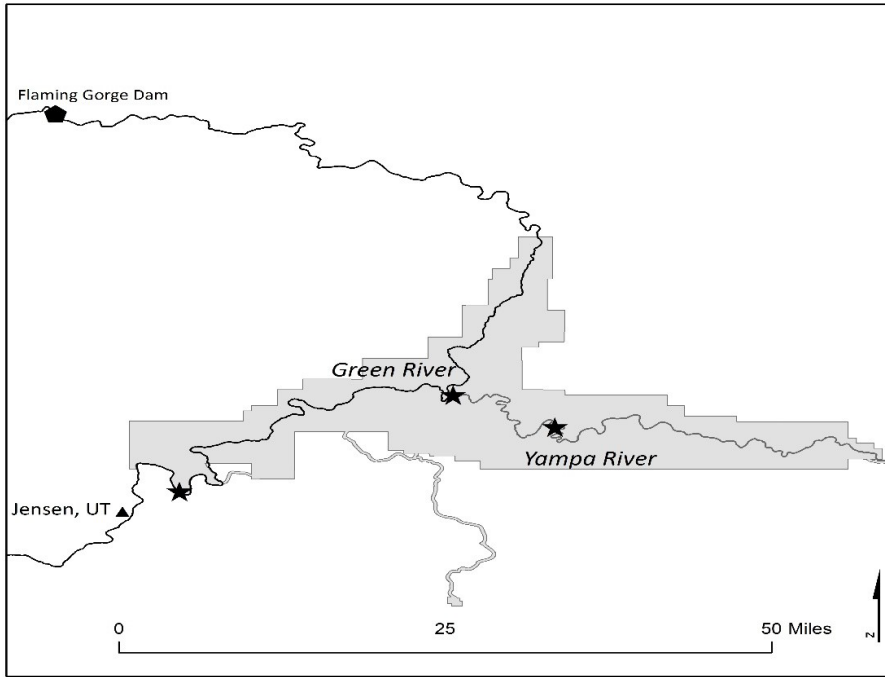
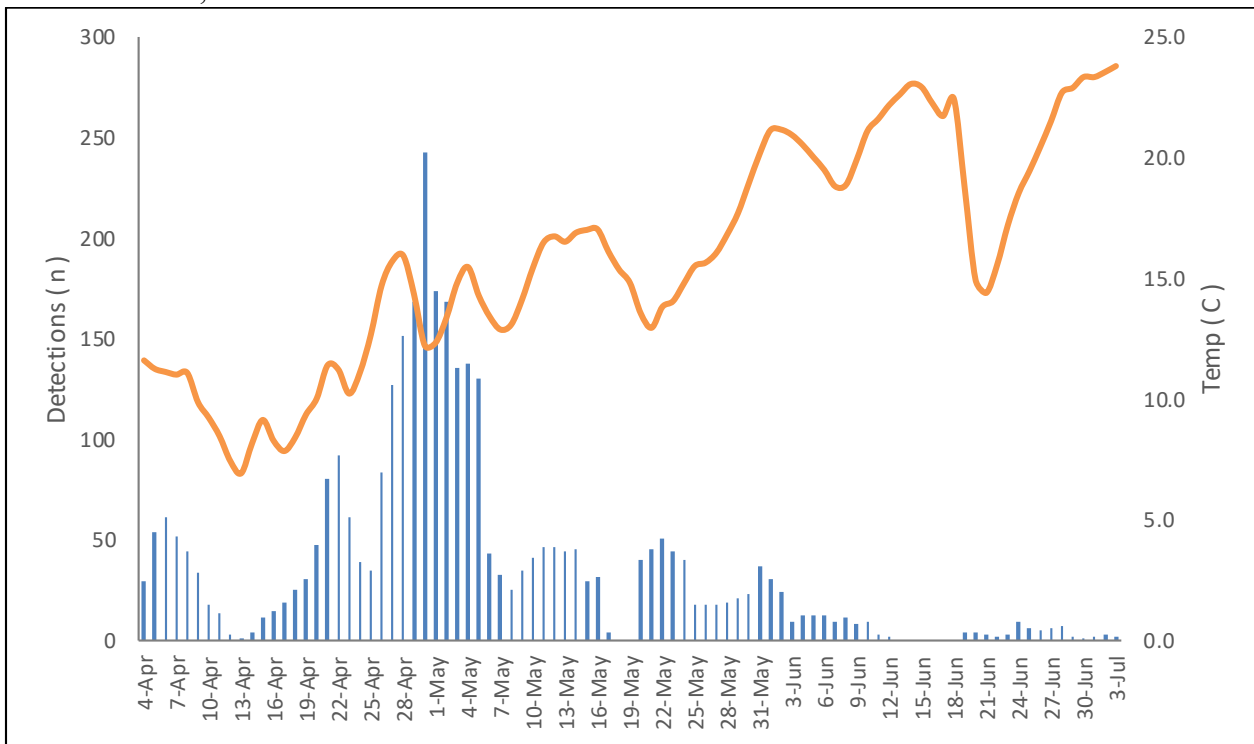


Figure 2. Number of individual or unique Razorback Sucker PIT tags detected each day and daily mean temperature (USGS gauge 09261000, located near Jensen, UT) during the 2021 sampling season at Razorback Bar, UT



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Figure 3. Number of Razorback Sucker PIT tags detected at Razorback Bar in 2021 that have been detected at this site in other years.

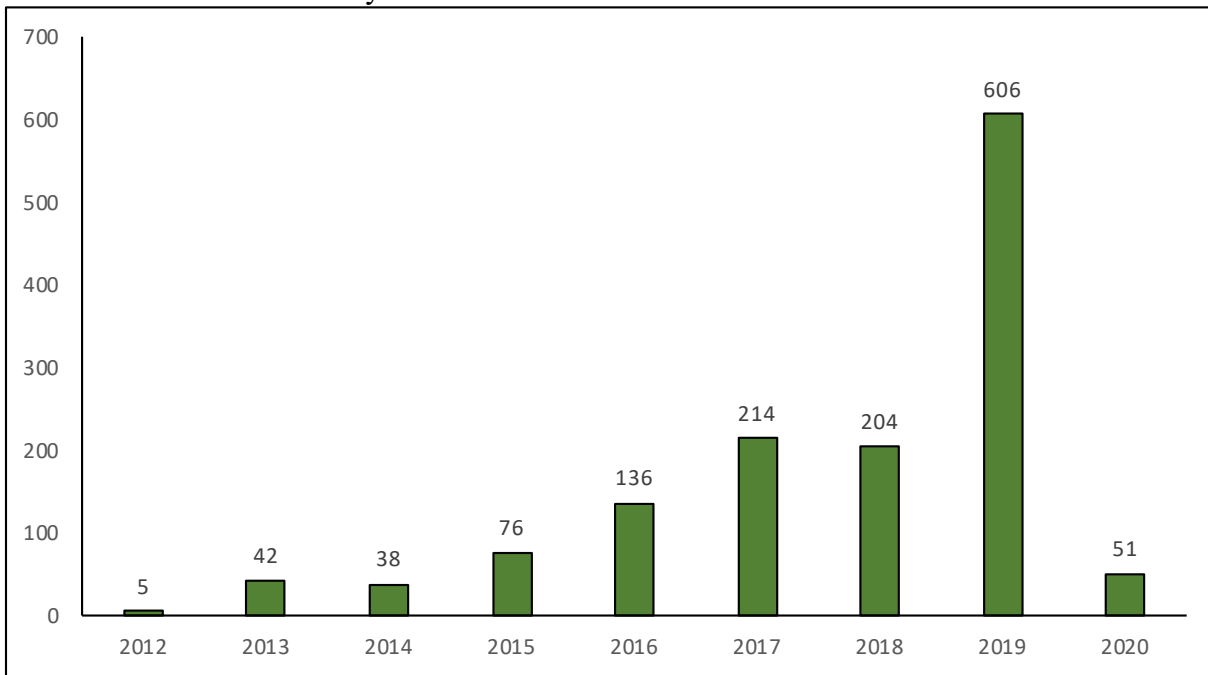
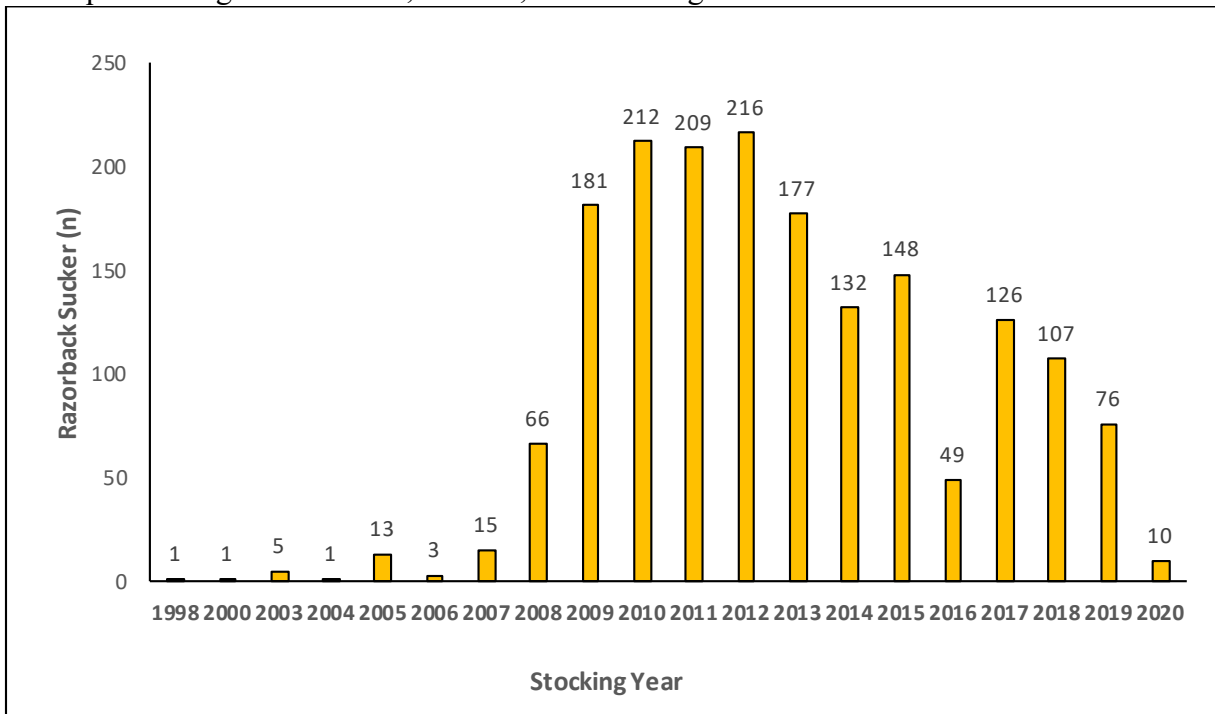


Figure 4. Stocking year and number of unique detections for Razorback Sucker detected by Razorback Bar PIT tag antennas in 2021. Note that incomplete stocking records reduced the number of unique PIT tag codes from 1,831 to 1,748 in this figure.



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Figure 5. Colorado River encounter locations and date of Razorback Sucker detected at Razorback Bar, UT in 2021.

