

# UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2020 ANNUAL REPORT

PROJECT: C-28a

## **Project Title**

Stationary PIT detection system in the Green River Canal, Green River, UT

## **Bureau of Reclamation Agreement Number:**

R15AC40021

## **Project/Grant Period:**

Start date: 04/01/2013

End date: undetermined

Reporting period end date: 09/30/2020

Is this the final report? No

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## **Abstract:**

The goal of this project is to evaluate entrainment of PIT-tagged endangered fish in the Green River Canal (near Green River, Utah) using passive interrogation arrays (PIAs). Entrainment at this facility has been monitored in this fashion since 2013 and observed entrainment rates of endangered fish since that time have been considerable owing to a lack of fish excluding structures at the canal intake. In FY 2019, the top of the Green River Canal was reconfigured to include an innovative fish exclusion structure which included a PIA to detect its efficacy. Whereas endangered fish entrainment rates in the unscreened canal varied during 2013-2019 from 118 to 695 fish per irrigation season (in 2018 and 2013, respectively), no PIT-tagged endangered fish were detected in the canal below the newly-completed screen during the 2019 irrigation season. During the 2020 irrigation season, two bonytail were detected in the canal downstream of the screen, representing 0.2% of all fish detected in the vicinity of the screen infrastructure (1,003 fish). While these two fish are the first to defeat the Green River Canal screen, entrainment rates since completion of the screen in 2019 have been drastically lower than those observed prior to screen construction.

## **Study Schedule:**

April 2013—indefinite

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## **Relationship to RIPRAP:**

Green River Action Plan

II: Restore habitat.

II.2.B: Screen Tusher Wash Diversion (aka Green River Canal) to prevent endangered fish entrainment, if warranted

II.2.B.b: Design.

II.2.B.c: Construct.

## **Accomplishment of FY 2020 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:**

Task 1: March-November, 2020 (irrigation season): Activate and operate system; download antennae data, perform diagnostics, repair system if necessary; system shut-down.

The goal of this project is to evaluate entrainment of PIT-tagged endangered fish in the Green River Canal (near Green River, Utah) using PIAs before and after construction of a fish excluding structure at the top of the canal. Canal entrainment at this facility has been monitored in this fashion since 2013. Observed entrainment rates of endangered fish since 2013 have been considerable owing to a lack of fish excluding structures at the canal intake at the time and through 2018; Table 1). In FY 2019, the top of the Green River Canal was reconfigured to include an innovative fish exclusion structure comprised of a weir wall with horizontal, fine-aperture screens at its crest (Figure 1) which diverts entrained fish back to the Green River while also delivering the canal's full capacity (ca. 85 cfs) to water users downstream. The screen was fitted with several PIT detection antennas and are configured as follows (Figure 2):

- a) Intake: Loops one (1; upstream) and two (2; downstream of 1): Weir and screen intake area just upstream of the trash rack.
- b) Return channel: Loops three (3; upstream) and four (4; downstream of 3): Fish return channel flowing to the Green River.
- c) Canal: Loops five (5) and six (6; downstream of 5): Below horizontal screen in the Green River Canal.

In 2020, the Green River Canal was flowing by April 4 (although there were several weeks of missing data prior to that date; Figure 3) and continued through Nov 22. Antenna arrays are continually operational and thus were working in advance of the canal start date. Loops 1 and 2 continued to experience interference (thought to be caused by a nearby steel trash rack) but detected fish at rates comparable to data collected by the old (pre-2019) system. Loop 3 (return channel) was disabled due to a PIT tag which became lodged between it and the infrastructure, causing a large volume of repeat detections. The PIT tag will be removed during the winter of 2020-2021. PIT antennas were not operating for about a week in April due to power outages, and high interference levels were documented periodically throughout the irrigation season. The canal antenna system was serviced on September 21, 2020.

Task 2: December: Annual report (current document).

During the 2020 irrigation season, 1,003 PIT-tagged fish were detected on the Green River Canal

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fish screen antennas, indicating continued visitation of the facility by fish (Table 2). The vast majority of detected fish were bonytail (84%), followed in order of abundance by razorback sucker (10%), Colorado pikeminnow (4%), unidentified (2%; presumably razorback sucker and bonytail), flannelmouth sucker (0.5%) and humpback chub (0.2%).

The overwhelming majority of these fish (881, or 88%) were detected only on the intake antennas; 11 fish (1%) were detected only on the return channel antennas, 109 fish (11%) were detected both on the intake and return channel antennas and two fish (0.2%) were detected on the intake and canal antennas. Since one of the two antennas in the return channel was not operating in 2020, it is likely many fish detected at the intake passed through the return channel undetected. In 2019, fish detected on both the intake and return channel antennas amounted to 34% of all detections but represented only 11% in 2020. If the second antenna loop in the return channel was running, we would expect roughly the same percentages in 2020 as 2019, but the differences suggests that some number of fish may have escaped by other means, i.e. through the canal radial gates upstream from the screen. This could be investigated further by deploying submersible antennas in the vicinity of the canal gates.

Whereas endangered fish entrainment rates in the canal have varied during 2013-2018 from 118 to 695 fish per irrigation season (Table 1), no tags were detected in the canal below the screen during the first year of operation (2019) but two PIT tags were detected there during the 2020 irrigation season. These tags were originally implanted in hatchery-reared bonytail and were detected on October 28 (six detections) and November 22 (one detection) as discharge in Green River Canal began to decline. Both tags had been detected on the intake antennas prior to appearing below the screen.

Since antenna systems are known to have detection efficiencies which are less than 100% under most conditions, also, we cannot rule out the possibility that additional entrainment didn't occur with the presence of the canal screen. Despite these caveats, the difference in entrainment rates before and after screen construction strongly suggests that entrainment rates are now markedly reduced over pre-screen levels observed in 2013 through 2018. While the current configuration of the fish screen obviously functions to markedly reduce entrainment from historical levels, it doesn't eliminate it. For example, a fish jumping at the correct angle could conceivably enter the canal through the gap at the bottom of the screen (Figure 1), which is probably less than a meter above the flowing water. Therefore, Biology Committee members should consider discussing a potential remedy with engineers.

### **Additional noteworthy observations:**

A single PIT-tagged adult female American beaver (*Castor canadensis*; not shown in Table 1) was detected in the canal as it was being drained in November 2020, most likely from either the San Rafael or Price River drainages.

As was conducted in 2019, we queried the STReAMS database to identify previously unidentified fish detected in the Green River Canal during 2013 through 2020. We assumed that since new information has continually been added to STReAMS since entrainment monitoring began in 2013, perhaps previously unidentified tags could now be identified. To perform this update, we first simply re-acquired species identification data from the STReAMS fish and encounter tabs

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using the tag numbers originally detected in the canal for the years 2013 through 2019. This action resulted in a limited number of positive identifications which had been added to the database since the Green River Canal monitoring began, but most previously unidentified tags still returned “unidentified” as a species designation. To further reduce the numbers of unidentified fish, we queried the PIT tag lot portion of the database using tags numbers which were still classified as “unidentified” after re-acquiring the data from fish and encounter portions of the database. The PIT tag lot database contains the purposes for which the original tag lots (100 each, generally) were intended for, i.e., tagging of bonytail *Gila elegans* or razorback sucker, field surveys, etc.

The STReaMS data query conducted in December 2020 resulted in updated detections from the Green River Canal for the 2019 irrigation season, but status of unidentified or putative identifications from previous years remained unchanged from the 2019 query. Of the updated data from 2019, we were able to positively identify 457 hatchery-reared bonytail, 2 humpback chub, one Colorado pikeminnow and one flannelmouth sucker, all of which had been listed as unidentified or putatively identified the year before

### **Recommendations:**

- Continue to operate and maintain the Green River Canal fish screen
- Continue to collect data using the existing antenna array and evaluate data in relation to canal operations.
- Consider evaluation of larval entrainment rates in the canal with the screen in place; also, since flows in the return channel are swift and turbulent, consider evaluating physical condition of fish that have passed through it.
- Consider querying principal investigators to determine whether additional data exists to aid in identifying currently unidentified fish species in STReaMS.
- Consider evaluating performance of antennas in the screen intake area in the presence of the steel trash rack which may be interfering with system signal strength.
- Consider deploying submersible portable antennas near the canal head gates to help determine movement of fish upstream and away from the Green River Canal.
- Consider potential for fish to bypass the screen and discuss remedies with engineers.

### **Project Status:**

Ongoing.

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## **FY 2020 Budget Status**

Funds Provided: \$0 – funds provided under SOW 179

Funds Expended: n/a

Difference: n/a

Percent of the FY 2020 work completed, and projected costs to complete: 100%

Recovery Program funds spent for publication charges: \$0

## **Status of Data Submission**

Data are automatically uploaded into STReaMS.

## **Signed:**

/s/Dave Speas

Principal Investigator

Date: Dec 16, 2020

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Table 1. Detections of PIT-tagged fish in the Green River Canal near Green River, UT during the 2013 through 2019 irrigation seasons according to STReAMS database (accessed December 2020). Asterisk (\*) reflects data collected after screen installation in 2019 and indicates fish detected near the fish screen but not entrained in the canal. “Presumed” indicates tags assigned for a specific purpose (e.g., stocked bonytail or razorback) but were recorded as “unidentified” when detected. These counts are included in the total for “unidentified”.

Species	2013	2014	2015	2016	2017	2018	2019*	Total
Flannelmouth sucker <i>Catostomus latippinis</i>	7	6	4	0	4	2	2	25
Bluehead sucker <i>Catostomus discobolus</i>	0	0	0	0	0	1	0	1
FMS x RZB	1	1	0	1	0	0	0	3
Humpback chub <i>Gila cypha</i>	1	1	1	2	0	2	2	9
Bonytail	8	27	77	57	42	20	900	1131
Colorado pikeminnow <i>Ptychocheilus lucius</i>	105	22	21	25	24	15	17	229
Razorback sucker	531	304	182	136	174	58	134	1519
Unidentified	42	55	20	19	34	20	22	212
<i>Presumed Bonytail</i>	2	0	8	1	2	0	0	13
<i>Presumed Razorback</i>	7	28	6	14	6	0	4	61
<b>Total</b>	<b>695</b>	<b>416</b>	<b>305</b>	<b>240</b>	<b>278</b>	<b>118</b>	<b>1077</b>	<b>3129</b>

Table 2. Detections of PIT-tagged fish in the Green River Canal near Green River, UT during the 2020 irrigation season. “Presumed” indicates tags assigned for a specific purpose (e.g., stocked bonytail or razorback) but were recorded as “unidentified” when detected. These counts are included in the total for “unidentified”.

Species	Intake only	Return only	Intake/return	Intake/canal	Total
Bonytail	741	8	89	2	840
Colorado pikeminnow	35	0	1	0	36
Flannelmouth sucker	4	0	1	0	5
Razorback sucker	82	2	15	0	99
Humpback chub	2	0	0	0	2
Unidentified	17	1	3	0	21
<i>Presumed Razorback</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	0	6
<i>Presumed Bonytail</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	0	2
<b>Total</b>	<b>881</b>	<b>11</b>	<b>109</b>	<b>2</b>	<b>1,003</b>

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Figure 1. Green River Canal fish screen in operation, looking downstream. Water flows left to right over the screen (foreground right). Screened water drops into the canal entrance while fish and unscreened water is collected and diverted back to the Green River. Note the gap above downstream end of screen, which could allow jumping fish a means enter the canal. Photo: Ryan Christianson, USBR.

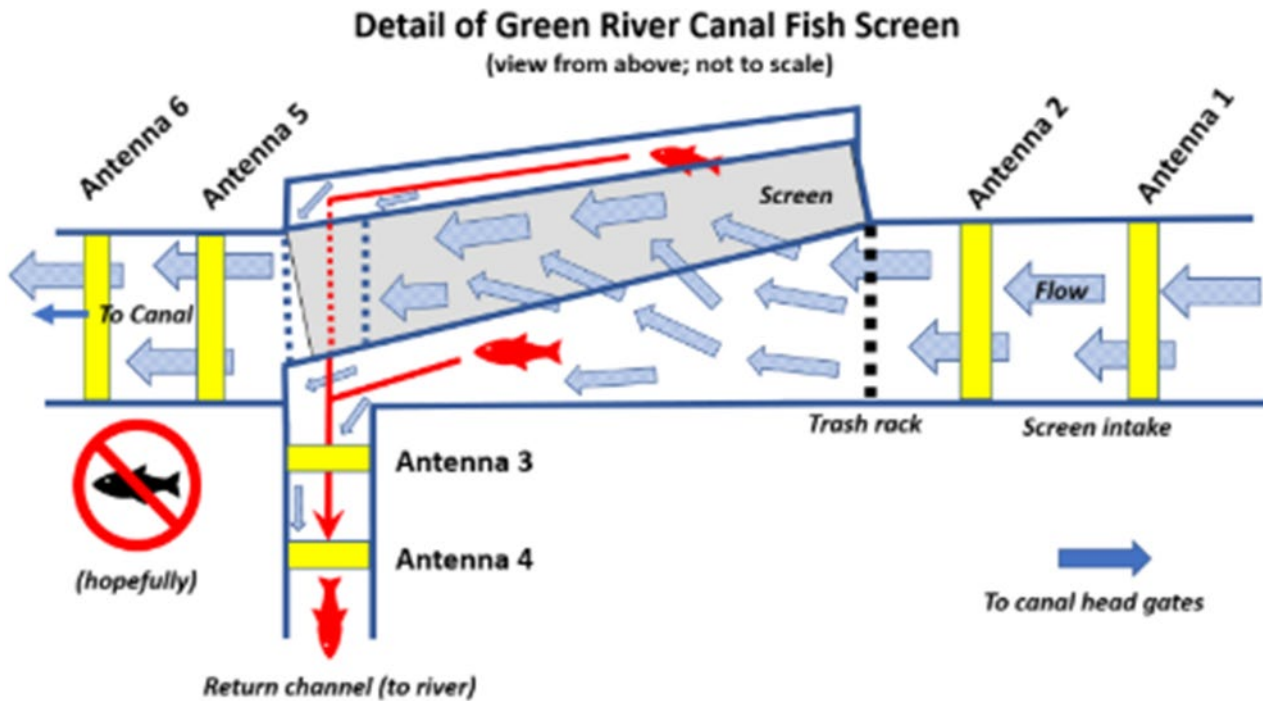


Figure 2. Schematic of the Green River Canal fish screen as viewed from above showing direction of flow (right to left) and location of PIT antennas.

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GREEN RIVER GREEN RIVER CANAL COMPANY

Mean daily discharge in CFS for year 2020

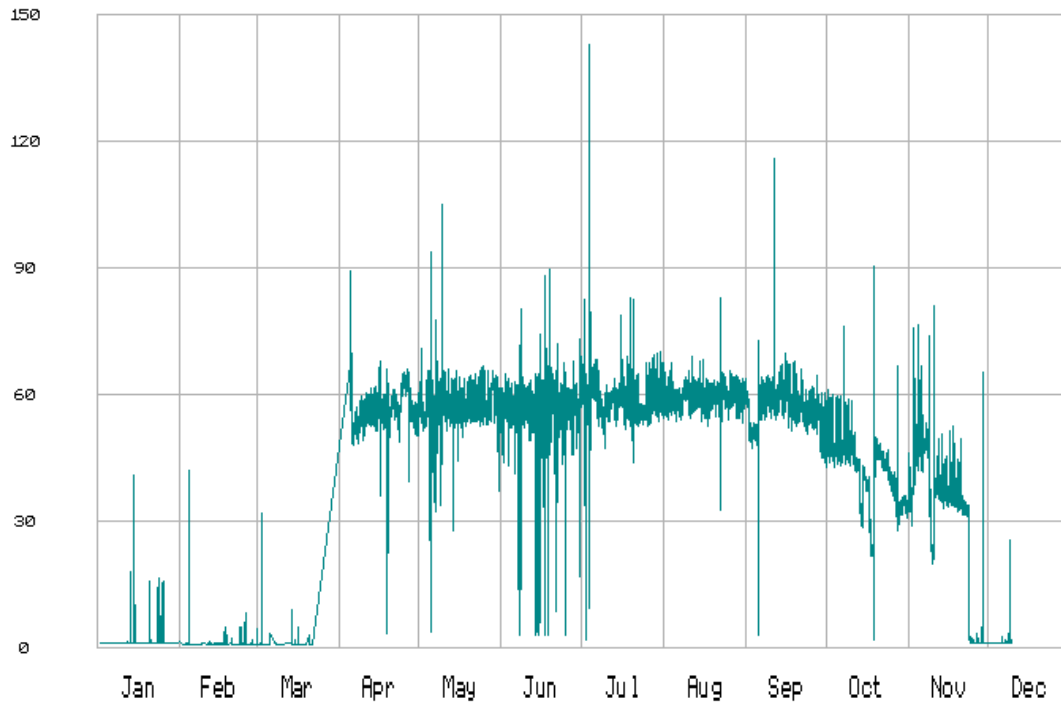


Figure 3. Mean daily discharge (cfs) in the Green River Canal, 2020. Data were obtained from <https://www.waterrights.utah.gov/cgi-bin/dvrtview.exe>.