

# UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2022 ANNUAL REPORT

PROJECT: C-28a

## **Project Title**

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

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

R19AC00153

## **Project/Grant Period:**

Start date: 09/16/2019

End date: 09/30/2024

Reporting period end date: 12/01/2022

Is this the final report? No

## **Principal Investigators:**

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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 was considerable owing to a lack of fish excluding structures at the canal intake. In FY 2019, a fish screen was installed at the headgate of the Green River Canal along with several PIT antenna loops 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), entrainment of PIT tagged fish in the screened canal (i.e., post 2019) has been 2 fish per season or less. Between December 1, 2021 and December 2022, a total of 475 fish were detected in the vicinity of the fish screen, including 35 bonytail, 18 Colorado pikeminnow, 9 flannelmouth sucker, two flannelmouth x razorback sucker hybrids, 139 razorback sucker, and 272 unidentified fish. About 67% of unidentified fish are presumed to be stocked bonytail, and ten unidentified fish were determined to be wild-spawned razorback sucker recently tagged at Stewart Lake near Jensen, UT. No fish were detected in the canal downstream from the fish screen, however two beavers from the Price River drainage were detected there. Entrainment rates since completion of the screen in 2019 continue to be drastically lower than those observed prior to screen construction.

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## **Study Schedule:**

April 2013—indefinite

## **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 2021 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:**

Task 1: Operate and maintain PIA system; perform diagnostics, repair system if necessary.

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 during 2013 - 2018 were considerable owing to a lack of fish excluding structures at the canal intake (Table 1). In 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 most of 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 2022, the Green River Canal started flowing on April 3, continued through Nov 17, and averaged about 90 cfs during that period (preliminary data, Utah Division of Water Rights; <https://www.waterrights.utah.gov/cgi-bin/dvrtview.exe>). Antenna arrays are continually operational and thus were working in advance of the canal start date. One site visit to the facility was conducted in March 2022, and no system abnormalities were noted.

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

During the 2022 irrigation season<sup>1</sup>, a total of 475 PIT-tagged fish was detected on the Green River

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<sup>1</sup> represented in this report by data collected during December 1, 2021 through December 1, 2022 (downloaded from STReaMS December 1, 2022; <https://streamsystem.org>).

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Canal fish screen antenna loops, indicating continued fish visitation of the facility (Table 2). The majority of detected fish were unidentified (57%), followed in order of abundance by razorback sucker *Xyrauchen texanus* (29%), bonytail *Gila elegans* (7%), Colorado pikeminnow *Ptychocheilus lucius* (4%), flannelmouth sucker *Catostomus latipinnis* (2%), and flannelmouth/razorback sucker hybrids (<1%). In previous years, tags associated with bluehead sucker *Catostomus discobolus* and humpback chub *Gila cypha* have been detected entering the canal or in the vicinity of the screen. Neither species was detected in the 2022 irrigation season, although it is possible some of the unidentified tags could belong to fish of either species.

About 67% of unidentified fish are most likely stocked bonytail from Wahweap State Fish Hatchery, with the remainder mostly a mix of stocked razorback and bonytail from Ouray National Fish Hatchery (Randlett). Ten unidentified fish (detected October 13-29) had tags deployed by Utah Division of Wildlife Resources, who reported that all ten fish were wild razorback sucker tagged at Stewart Lake near Jensen, UT, during draining and tagging operations in September and October 2022 (Matt Breen, UDWR, personal communication).

About 42% of all fish were detected only on return channel antennas loops, which is in stark contrast to previous findings whereby no more than 17% of fish were detected in this area of the screen. Conversely, about 35% of fish were detected both on the intake and return channel loops, which is consistent with results from 2019 (34%) and 2021 (47%). The relatively low fraction of fish detected on the intake antenna loops in 2022 (22%, compared to 42-88% in previous years) could be due to close proximity of intake antennas to steel trash racks, which could be interacting with the electromagnetic field of the antenna and reducing efficiency. A more detailed look at the detection chronology in 2022 in relation to data on system noise from that period (if available) could aid in understanding the relatively low detection rate.

No fish were detected in the Green River Canal below the fish screen in 2022. Whereas endangered fish entrainment rates in the canal varied during 2013-2018 from 118 to 695 fish per irrigation season (Table 1), entrainment rates since construction of the fish screen in 2019 have been markedly reduced. No tags were detected in the canal below the screen during the first year of operation (2019), two PIT-tagged bonytail were detected there during the 2020 irrigation season, and a single bonytail was detected below the screen in 2021.

Since antenna systems are known to have detection efficiencies which are less than 100% under most conditions, 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 indicates that entrainment rates are now markedly reduced over pre-screen levels observed in 2013 through 2018. While the current configuration of the fish screen functions to markedly reduce entrainment from historical levels, it obviously doesn't eliminate it. Exactly how a few fish have bypassed the screen is unknown, but it appears that a fish jumping at the correct angle could conceivably enter the canal through the gap at the downstream end 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.

*Other noteworthy observations:* Two PIT-tagged beavers *Castor canadensis* were detected in the canal below the fish screen in 2022. Both animals had been introduced by Utah State University

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and the Utah Division of Wildlife Resources into the Price River drainage, one individual in May and one in September of 2022. The latter individual was detected near the mouth of the Price River on September 20 (one day after introduction), was detected at the Green River Canal several times on November 11, and returned to the mouth of the Price River on November 17. The fate of the beaver introduced in May isn't known. Detection of a beaver in the canal happened once before in 2020.

### **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.
- Query 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. This can be done by deploying submersible portable antennas near the canal head gates and comparing results those obtained at the screen intake arrays. Submersible data may also shed light on movement of fish out of the Green River Canal area.
- Consider potential for fish to bypass the screen and discuss remedies with engineers.

### **Project Status:**

Ongoing.

### **FY 2022 Budget Status**

Funds Provided: See project 179 annual report

Funds Expended: n/a

Difference: n / a

Percent of the FY 2021 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 2, 2022

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Table 1. Detections of PIT-tagged fish in the Green River Canal near Green River, UT during 2013 through 2021. Asterisk (\*) reflects data collected after screen installation in 2019 and indicates fish detected near the fish screen but not entrained in the canal; (\*\*) indicates fish were entrained in the canal that year (see text). “Presumed” indicates tags assigned for a specific purpose (e.g., stocked bonytail or razorback) but were recorded as “unidentified” when detected (included in the total for “unidentified”).

Species	2013	2014	2015	2016	2017	2018	2019*	2020*	2021*	Total
Flannelmouth sucker	7	6	4	0	4	2	2	5	25	55
Bluehead sucker	0	0	0	0	0	1	0	0	0	1
FMS x RZB	1	1	0	1	0	0	0	0	4	7
Humpback chub	1	1	1	2	0	2	2	2	1	12
Bonytail	8	27	77	57	42	20	900	840**	1,187**	2318
Colorado pikeminnow	105	22	21	25	24	15	17	36	40	305
Razorback sucker	531	304	182	136	174	58	134	99	385	2003
Unidentified	42	55	20	19	34	20	22	21	82	315
<i>Presumed Bonytail</i>	2	0	8	1	2	0	0	6	6	25
<i>Presumed Razorback</i>	7	28	6	14	6	0	4	2	18	85
<b>Total</b>	<b>695</b>	<b>416</b>	<b>305</b>	<b>240</b>	<b>278</b>	<b>118</b>	<b>1,077</b>	<b>1,003</b>	<b>1,724</b>	<b>5,856</b>

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Table 2. Detections of PIT-tagged fish in the Green River Canal near Green River, UT during Dec. 1, 2021 through Dec. 1, 2022 (accessed Dec. 1, 2022; <https://streamsystem.org>). “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”.

	Intake only	Return only	Intake and return	Canal	Total individual fish
Bonytail	9	14	12	0	35
Colorado pikeminnow	7	7	4	0	18
Flannelmouth sucker	4	2	3	0	9
Razorback sucker	52	26	61	0	139
FM x RZ hybrid	1	0	1	0	2
Unidentified	35	149	86	0	272
<i>Presumed Razorback</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>0</i>	<i>unk</i>
<i>Presumed Bonytail</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>	<i>0</i>	<i>≥137</i>
<b>Total</b>	<b>108</b>	<b>198</b>	<b>167</b>	<b>0</b>	<b>475</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

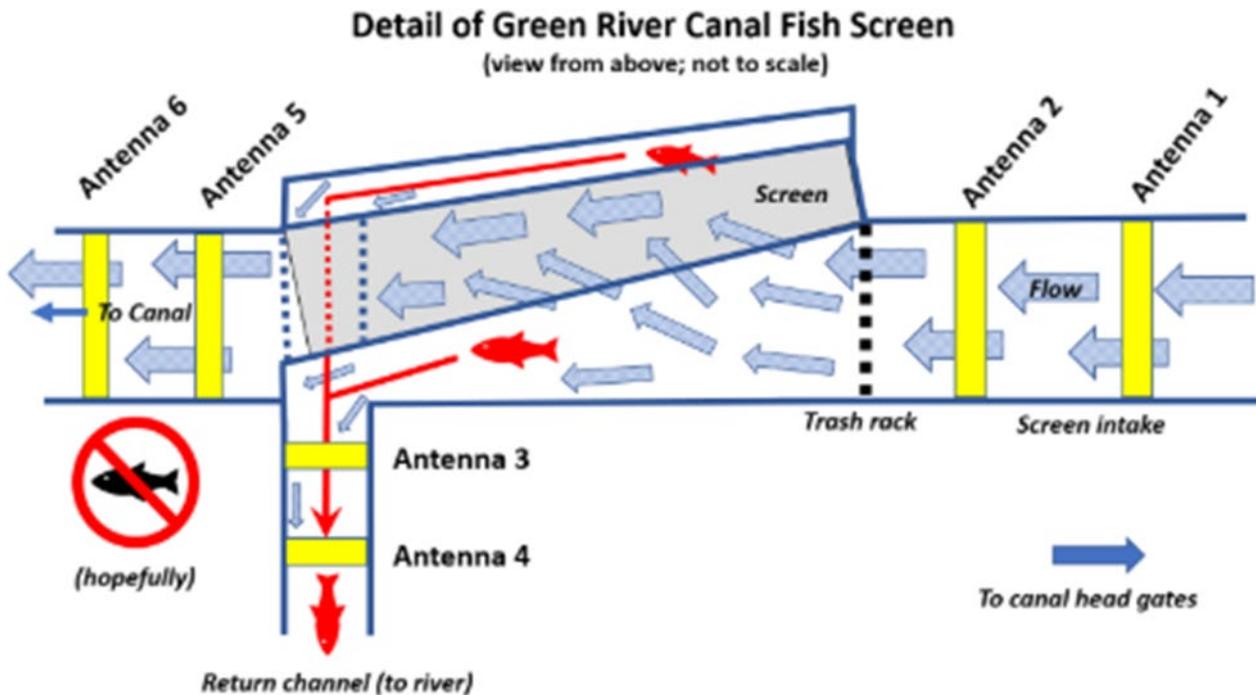


Figure 2. Schematic of the Green River Canal fish screen as viewed from above showing direction of flow (right to left) and location of PIT antennas.