

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2023 ANNUAL REPORT

PROJECT(s): C4b-GVP

Project Title

Annual Operation and Maintenance of the Fish Passage Structure at the Government Highline Diversion Dam on the Upper Colorado River and Price-Stubb Fish Passage

Bureau of Reclamation Agreement Number:

R20PG00024

Project/Grant Period:

Start date: 10/01/2019

End date: 09/30/2024

Reporting period end date: 09/30/2023

Is this the final report? Yes No

Principal Investigator:

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Abstract:

The purpose of this project is to collect and summarize annual data on the overall number of large-bodied fish, number of different fish species, and seasonal distribution of fish use at the fish passageway at the Government Highline diversion dam (aka Grand Valley Water Users [GVWU] dam) on the upper Colorado River in De Beque Canyon. This fish passage structure has been operated during 17 of the last 19 years, since construction was completed in August 2004.

In 2023, GVWU Fish Passage was operational from 20 April through 27 September. A total of 14,906 fish used the fish passage over a 160-day period in 2023. Four endangered bonytail (*Gila elegans*), four endangered Colorado pikeminnow (*Ptychocheilus lucius*), two threatened humpback chub (*Gila cypha*), and 47 endangered razorback sucker (*Xyrauchen texanus*) made passage.

Study Schedule:

2004-Ongoing

Relationship to RIPRAP:

Colorado River Action Plan

II.B. Restore native fish passage at instream barriers.

II.B.2. Restore fish passage at Price-Stubb

II.B.2.a.(4) Operate and maintain

II.B.2.a.(5) Monitor and evaluate success

II.B.3. Restore fish passage at Government Highline (aka Grand Valley Water Users).

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II.B.3.a.(3). Operate and maintain

Accomplishment of FY 2023 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

GVWU Fish Passage

In 2023, four bonytail were collected in the GVWU fish trap (Tables 1, 2, and 3). The fish ranged in total length from 236 to 318 mm with a mean of 372 mm. One was stocked near Rifle, Colorado in July 2022. The remaining three have not had their tagging encounter uploaded into STReAMS. One-hundred-sixty bonytail have now made passage at this facility (Table 3).

In 2023, a record four Colorado pikeminnow made passage at the GVWU passage. The fish ranged in total length from 510 to 703 mm with a mean of 610 mm. One Colorado pikeminnow was newly tagged on this encounter. One fish was tagged September 2020 in Black Rocks. The third fish was tagged October 2014 near Cisco, Utah. The fourth's initial tagging encounter was not found in STReAMS. Twelve Colorado pikeminnow have now made passage at this facility (Table 3).

Two humpback chub made passage at GVWU passage in 2023. The humpback chubs' total lengths were 200 and 215 mm, and both were PIT tagged on this occasion. Fourteen humpback chub have now made passage at this facility since 2005 (Tables 3). In the late 1970's Dr. Richard Valdez, while working for our office, described a population of humpback "like" chub collected from the Beavertail stretch of DeBeque Canyon of the Colorado River (Valdez et al. 1982). Our office has now sampled Debeque Canyon in 2022 (collecting seven humpback chub) and in 2023 (collecting four humpback chub). Only one humpback chub collected in 2023 was a recapture of a 2022 fish. None of the ten individuals collected in the canyon had been encountered prior to these efforts. A small caudal fin clip was collected from these specimens for future genetic testing (Francis, 2022 and 2023).

In 2023, 47 razorback sucker were collected in the GVWU fish trap (Tables 1, 2 and 3). These fish ranged in total length from 355 to 554 mm with a mean of 442 mm. These fish were stocked at a variety of locations between the years of 2013 and 2022. A total of 361 razorback sucker have now made passage at this facility (Table 3).

A total of 14,906 fish were collected in the trap of the GVWU Dam fish passage from 20 April through the 27 September 2023. The highest totals ever collected in the trap were in 2014 (n = 24,670) and 2022 (n = 21,387; Table 4). This is the seventeenth year of operation since the structure was completed. This facility has been operated for different lengths of time during various times of year, since 2004, thus making specific year-to-year comparisons about yearly catch totals and species composition discouraged.

Native fishes (and their hybrid forms) accounted for 75.4% (n = 11,236) of the total catch in 2023 (Table 4). Nonnative fishes (and native by nonnative hybrid fish) accounted for 24.6% (n = 3,670) of the total catch in 2023. For 2023, flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*), and roundtail chub (*Gila robusta*) combined accounted for almost 75% of the total catch (Table 1), and these three native species have dominated the total catch since the ladder began operation. The most prevalent nonnative fish found in the fish trap from 2013 to 2023 was white sucker (*Catostomus commersonii*). Channel catfish (*Ictalurus punctatus*), which were not found between

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GVWU and Price-Stubb dams prior to completion of the non-selective fish passage at Price-Stubb dam in April 2008, were once again collected in the GVWU fish passage during 2023 (n = 296; Table 1).

One largemouth bass (*Micropterus salmoides*; total length 370 mm) and 15 smallmouth bass (*Micropterus dolomieu*; total lengths ranged from 183 to 257 mm with a mean of 229 mm) were also collected and removed in 2023. No gizzard shad (*Dorosoma cepedianum*) were collected and removed in 2023 (Table 1).

All fish found in the fish trap were counted and sorted by species. All native fish, as well as nonnative rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), lake trout (*Salvelinus namaycush*), and brown trout (*Salmo trutta*) were released upstream of GVWU diversion dam. All channel catfish were returned alive immediately downstream from the dam. All other nonnative fish, including native X nonnative hybrid suckers were removed.

Price-Stubb Antenna

The Price-Stubb PIT tag antennas (5 miles downstream of GVWU) produced multiple detections on 541 unique PIT tags (FY record) during FY 2023 (Table 5); many of these tags were detected on multiple days. We have reported in past years that a recurring and problematic issue has been data for many PIT-tagged fish whose original tagging information was not being submitted to STReAMS: in FY 2023 the number of unknown tags has remained high at 32% (n = 172). Most of these unidentified tags were not in the PIT tag distribution database, so they likely represent “three species” tags deployed by Colorado Parks and Wildlife. Bluehead sucker (n = 32), bonytail (n = 75), *Gila* unidentifiable to species (n = 1), Colorado pikeminnow (n = 6), flannelmouth sucker (n = 127), razorback sucker (n = 75), roundtail chub (n = 53), and flannelmouth sucker X bluehead sucker hybrids (n=3) made up the individual PIT tag detections that could be found in STReAMS (many were detected on multiple dates) during FY 2023. Table 5 gives a detailed breakdown of the fish that were detected by the antenna by month, and Table 6 gives annual individual totals by species.

Operation and Maintenance

In 2019, GVWU employees used a track hoe to remove sediment in front of the attraction flow, fish ladder entrances, and fish return tube. Spring runoff in 2020-2022 was moderate in magnitude and duration and redeposited only a small amount of sediment which allowed the facility to operate properly. Spring runoff in 2023 was above average in both magnitude and duration, and there is now enough sediment (cumulation over the years) in front of the fish return tube and forebay to the fish passage that track hoe removal is warranted again. In spring 2016 through 2023, GVWU opened the roller closest to the fish passage for several weeks during high spring flows to help sluice away the sediment bar. This has helped tremendously with sediment management. It is our recommendation that this action be continued into future years, as the natural sluicing provided during high flows can move considerably more sediment than can physical removal via track hoe.

Beginning in 2022, the slide gate at the top of the fish passage no longer fully closes squarely and water cannot be fully diverted back to the river. We suggest the gate needs to be fully dismantled and repaired in a future year during the winter.

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Weeds were sprayed and removed from the property throughout 2023.

At the Price-Stubb non-selective fish passage facility (5 miles downstream of the GVWU Fish Passage), debris and trash build-up were high after a high and protracted spring runoff. We worked with Bureau of Reclamation (BOR), the water users, and a contractor who operated a track-hoe to clean the debris out of the passage on 10th August 2023. We provided four staff to wade/swim between the baffles and remove the debris the track-hoe couldn't access.

Additional noteworthy observations:

Our office (i.e., Benjamin Schleicher) deployed portable submersible antenna throughout GVWU Fish Ladder during the FY 2023 season of operation and had one at the base of the ladder for the entire year. Please see Tables 7 and 8 for those results.

Recommendations:

Biological:

Continue to collect information on the number of fish, by species, in the fish trap of the GVWU fish passageway in 2024 starting about mid-April and running through mid-October, if river flows and funding allow. These tentative dates may need to be adjusted, based upon the ability of the adjacent Grand Valley Water Users canal, as well as downstream water diversions, to get sufficient quantities of water to fill their canals.

Continue collecting data from Price-Stubb antenna.

Operation and Maintenance:

The Government Highline (aka GVWU) fish ladder is located on the inside (river left) bend of the river, directly across the river from the GVWU canal head gates, which means that this location will naturally sediment in over time, and manual sediment removal will have to be repeated at regular (1-2 year) intervals. Sediment removal via sluicing (when flows are over 4,000 CFS at this location) and track hoe removal is recommended in FY 2024. Unfortunately, the vegetated bank on river left has reformed (as it did within one year following 2015 sediment removal). The reforming and downstream migration of the heavily vegetated, river left bank causes a slack water (almost backwater) area to form in front of the fish return tube, which in turn causes fish being returned to the river (especially during low water periods) via the fish return tube to be dumped into shallow, still water. This reduces their ability to identify the adjacent main river channel and its current that naturally leads them to move into deeper, flowing water (ideally moving upstream) after being returned to the river. Instead, they tend to linger in this slack water area, just outside the fish return tube, until the fish ladder entrance is opened back up. Once the fish ladder entrance is opened back up, strong flows at that site can lead to fish becoming impinged on the upstream trash racks, leading to injury and/or death. If/when sediment removal is performed in front of the fish ladder entrance via track hoe, we strongly recommend removing/peeling back as much of the river left bank immediately upstream of the fish return tube as is feasible, to facilitate quick and safe movement of fish away from the fish return tube area. Again, this activity will need to be performed on a regular (1-2 year) basis.

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During spring high flow periods of 2014-2023 (usually at flows $\geq 4,000$ CFS at the Cameo gage), GVWU has opened the roller closest to the fish passage. The natural sluicing action that this causes is very effective at removing large amounts of sediment from in front of the fish passage in a very short period of time. We feel that having GVWU continue to sluice during spring high flow periods by raising the roller closest to the fish passage is highly beneficial.

Beginning in 2022, the slide gate at the top of the fish passage no longer fully closes squarely and water cannot be fully diverted back to the river. We suggest the gate needs to be fully dismantled and repaired in a future year during the winter.

The cam connection for the trash pump was damaged when pulling the pump for winterization. That pipe will be dug up and repaired prior to FY-2024 operation.

Project Status:

On track, ongoing, complete, etc.

FY2023 Budget Status

Funds Provided: \$58,592.00

Funds Expended: \$58,592.00

Difference: -0-

Percent of the FY 2023 work completed, and projected costs to complete: 100%

Status of Data Submission

Data was uploaded into STReaMS 10/11/2023.

Signed:

Travis Francis

Principal Investigator

11/9/2023

Literature Cited

Francis, T.A. 2023. Population Estimate of Humpback Chub (*Gila cypha*) in Black Rocks. Annual Report from the U.S. Fish and Wildlife Service to the Upper Colorado River Endangered Fish Recovery Program, Project Number C4b-GVP. Grand Junction, Colorado.

Francis, T.A. 2022. Population Estimate of Humpback Chub (*Gila cypha*) in Black Rocks. Annual Report from the U.S. Fish and Wildlife Service to the Upper Colorado River Endangered Fish Recovery Program, Project Number C4b-GVP. Grand Junction, Colorado.

Valdez, R., P. Mangan, R. Smith, B. Nilson. 1982. Upper Colorado River Investigation (Rifle, Colorado to Lake Powell, Utah). U.S. Fish and Wildlife Service report to the U.S. Bureau of Reclamation.

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Table 1.

Total number of juvenile and adult fish captured in the fish trap of the passageway at the Grand Valley Water Users Diversion Dam during 2023.

| Common Name | Number of Fish | Percent of Total Fish |
|--|----------------|-----------------------|
| NATIVE FISH | | |
| bluehead sucker | 2,142 | 14.37 |
| bonytail | 4 | 0.03 |
| Colorado pikeminnow | 4 | 0.03 |
| Colorado cutthroat | 0 | 0.00 |
| flannelmouth sucker | 7,080 | 47.50 |
| humpback chub | 2 | 0.01 |
| mottled sculpin | 0 | 0.00 |
| mountain whitefish | 54 | 0.36 |
| razorback sucker | 47 | 0.32 |
| roundtail chub | 1,879 | 12.61 |
| speckled dace | 1 | 0.01 |
| TOTAL | 11,213 | 75.22 |
| NONNATIVE FISH | | |
| black bullhead | 13 | 0.09 |
| bluegill | 1 | 0.01 |
| brook trout | 0 | 0.00 |
| brown trout | 21 | 0.14 |
| channel catfish | 296 | 1.99 |
| common carp | 36 | 0.24 |
| green sunfish | 2 | 0.01 |
| lake trout | 0 | 0.00 |
| gizzard shad | 2 | 0.01 |
| largemouth bass | 1 | 0.01 |
| longnose sucker | 54 | 0.36 |
| northern pike | 0 | 0.00 |
| rainbow trout | 8 | 0.05 |
| smallmouth bass | 15 | 0.10 |
| white sucker | 2,270 | 15.23 |
| TOTAL | 2,719 | 18.24 |
| HYBRID FISHES | | |
| Native X Native Hybrids: | | |
| razorback X flannelmouth sucker | 0 | 0.00 |
| bluehead X flannelmouth sucker | 23 | 0.15 |
| Native X Nonnative Hybrids: | | 0.00 |
| bluehead X white sucker | 135 | 0.91 |
| bluehead X flannelmouth X white sucker | 0 | 0.00 |
| flannelmouth X white sucker | 816 | 5.47 |
| bluehead X longnose sucker | 0 | 0.00 |
| flannelmouth X longnose sucker | 0 | 0.00 |
| white X longnose sucker | 0 | 0.00 |
| ALL TOTALS | 14,906 | 100.00 |

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Table 2. 2023 GVWU PIT tagged fish histories.

| Month of Passage | Species | PIT Tag Histories |
|------------------|----------------------------|--|
| April-23 | roundtail chub N=1 | N=1 tagging encounter not in STReaMS; detected in April and September 2023 at Price Stubb |
| June-23 | humpback chub N=1 | N=1 tagged at this capture event at GVWU Passage |
| | razorback sucker N=2 | N=1 stocked August 2017 in Rifle at CO RMI 240.7; this fish also made passage at GVWU in June 2022 N=1 stocked September 2020 in Rifle at CO RMI 240.7; this fish also made passage at GVWU in June 2022 |
| | roundtail chub N=2 | N=2 tagging encounter not in STReaMS; one was detected in April and September 2023 at Price Stubb and made passage at GVWU in April 2023 |
| July-23 | Colorado pikeminnow N=1 | N=1 tagged October 2014 downstream of Cisco, UT at CO RMI 107.8; recaptured July 2022 upstream of Cisco, UT at CO RMI 112.8 |
| | humpback chub N=1 | N=1 tagged at this capture event at GVWU Passage |
| | razorback sucker N=16 | N=1 stocked October 2014 in Rifle at CO RMI 240.7 N=2 stocked September 2016 in Rifle at CO RMI 240.7; one detected multiple times at GVWU Ladder in 2019, 2020, and 2021 and detected at Price Stubb in 2022 N=1 stocked September 2018 in Rifle at CO RMI 240.7; detected multiple times at GVWU Ladder in 2020 N=1 stocked September 2017 in Rifle at CO RMI 240.7; made passage July 2022 at GVWU N=4 stocked September 2020 in Rifle at CO RMI 240.7; one detected and captured just below GVWU Ladder in September-October 2022; one detected below GVWU 2021 and made passage June 2022 at GVWU; two detected below GVWU 2021 N=2 stocked September 2021 in Rifle at CO RMI 240.7 N=4 stocked September 2022 in Rifle at CO RMI 240.7 N=1 tagging encounter not in STReaMS |
| | roundtail chub N=4 | N=2 tagged October 2020 in Westwater CO RMI 120.8 and 124.5; both detected July 2023 at Price Stubb Ladder N=2 tagging encounter not in STReaMS; one made passage June 2022 at GVWU and was detected April 2023 at Price Stubb; one was detected in July 2023 at Price Stubb |
| Aug-23 | Colorado pikeminnow N=2 | N=1 tagging encounter not in STReaMS N=1 tagged at this capture event at GVWU Passage |
| | razorback sucker N=26 | N=1 stocked September 2013 in Rifle at CO RMI 240.7 N=1 stocked October 2014 in Rifle at CO RMI 240.7; detected multiple times in 2021 at Rifle backwater CO RMI 236.6 N=1 stocked April 2015 in Rifle at CO RMI 240.7 N=1 stocked September 2016 in Rifle at CO RMI 240.7; one made passage May 2017 and July 2022 at GVWU and was detected multiple times at GVWU Ladder in 2020, and 2021 N=1 stocked August 2017 in Rifle at CO RMI 240.7 N=7 stocked September 2020 in Rifle at CO RMI 240.7; one detected June 2022 in Roan Creek; one detected below GVWU August 2021 N=8 stocked September 2021 in Rifle at CO RMI 240.7; one recaptured May 2022 in Grand Junction at CO RMI 166.5 N=1 stocked September 2021 in Delta at GU RMI 57.1 N=4 stocked September 2022 in Rifle at CO RMI 240.7 N=1 tagged at this capture event at GVWU Passage |

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| Month of Passage | Species | PIT Tag Histories |
|------------------|----------------------------|--|
| | roundtail chub N=2 | N=2 tagging encounter not in STReaMS; one made passage June 2022 at GVWU and was detected April 2023 at Price Stubb; one was detected multiple times in 2021 and 2022 at Price Stubb |
| Sep-23 | bonytail N=4 | N=1 stocked July 2022 in Rifle at CO RMI 240.7 N=3 tagging encounter not in STReaMS |
| | Colorado pikeminnow N=1 | N=1 tagged September 2020 in Black Rocks CO RMI 136 |
| | razorback sucker N=3 | N=1 stocked September 2018 in Rifle at CO RMI 240.7 N=1 stocked September 2021 in Rifle at CO RMI 240.7 N=1 stocked September 2022 in Rifle at CO RMI 240.7 |
| | roundtail chub N=1 | N=1 tagging encounter not in STReaMS |

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Table 3.

Number of Colorado pikeminnow, razorback sucker, bonytail and humpback chub captured in the fish trap of the Grand Valley Water User’s passageway from 2005 through 2023.

| Year | Colorado pikeminnow | razorback sucker | bonytail | humpback chub |
|--------|---|------------------|----------|---------------|
| 2005 | 0 | 1 | 0 | 1 |
| 2006 | 0 | 0 | 0 | 0 |
| 2007 | Fish Passage not operated due to insufficient flows | | | |
| 2008 | 0 | 1 | 0 | 0 |
| 2009 | 0 | 0 | 0 | 0 |
| 2010 | 0 | 0 | 0 | 0 |
| 2011 | 0 | 0 | 22 | 2 |
| 2012 | Fish Passage not operated due to insufficient flows | | | |
| 2013 | 0 | 2 | 0 | 0 |
| 2014 | 1 | 25 | 14 | 0 |
| 2015 | 1 | 52 | 10 | 0 |
| 2016 | 1 | 36 | 44 | 0 |
| 2017 | 2 | 130 | 12 | 2 |
| 2018 | 0 | 4 | 0 | 2 |
| 2019 | 1 | 29 | 16 | 4 |
| 2020 | 0 | 6 | 3 | 0 |
| 2021 | 0 | 17 | 29 | 0 |
| 2022 | 2 | 11 | 6 | 1 |
| 2023 | 4 | 47 | 4 | 2 |
| Totals | 12 | 361 | 160 | 14 |

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Table 4.

Comparison of the total number of fish, total native vs. nonnative fishes, and percent composition of native and nonnative fish captured in the fish trap of the Grand Valley Water User’s passageway between 2005 and 2023.

| Year | Total Number of Fish | Total Native Fishes | Total Nonnative Fishes | Percent Composition | | Number of days operated |
|---------------|---|---------------------|------------------------|---------------------|------------------|-------------------------|
| | | | | Native Fishes | Nonnative Fishes | |
| 2004 | fish passageway & fish trap not run due to insufficient flows | | | | | 0 |
| 2005 | 4,638 | 2,867 | 1,771 | 61.8 | 38.2 | 12 |
| 2006 | 11,978 | 10,747 | 1,231 | 89.7 | 10.3 | 41 |
| 2007 | fish passageway & fish trap not run due to insufficient flows | | | | | 0 |
| 2008 | 10,788 | 9,663 | 1,125 | 89.6 | 10.4 | 166 |
| 2009 | 12,402 | 11,286 | 1,116 | 91 | 9 | 178 |
| 2010 | 18,390 | 16,358 | 2,032 | 89 | 11 | 182 |
| 2011 | 8,875 | 6,870 | 2,005 | 77.4 | 22.6 | 178 |
| 2012 | fish passageway & fish trap not run due to insufficient flows | | | | | 0 |
| 2013 | 13,401 | 10,702 | 2,699 | 79.9 | 20.1 | 49 |
| 2014 | 24,670 | 17,253 | 7,417 | 69.9 | 30.1 | 177 |
| 2015 | 14,248 | 12,094 | 2,154 | 84.9 | 15.1 | 140 |
| 2016 | 15,889 | 13,754 | 2,135 | 86.6 | 13.4 | 136 |
| 2017 | 13,581 | 11,352 | 2,229 | 83.6 | 16.4 | 183 |
| 2018 | 10,210 | 9,058 | 1,152 | 88.7 | 11.3 | 58 |
| 2019 | 11,862 | 9,339 | 2,523 | 78.7 | 21.3 | 146 |
| 2020 | 6,920 | 5,815 | 1,105 | 84 | 16 | 58 |
| 2021 | 14,190 | 10,438 | 3,752 | 73.6 | 26.4 | 52 |
| 2022 | 21,387 | 14,767 | 6,620 | 69.1 | 30.9 | 76 |
| 2023 | 14,906 | 11,236 | 3,670 | 75.4 | 24.6 | 160 |
| Totals | 213,429 | 172,363 | 41,066 | 80.8 | 19.2 | 1,992 |

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Table 5.
FY2023 Price-Stubbs PIT Antenna Detections

| Key For Initial Encounter Location | | |
|------------------------------------|-----------------|--|
| Upper CO River Reach | RMI 193.8-248 | Above GVWU Dam to Silt |
| Grand Valley Reach | RMI 152.6-193.7 | Loma to GVWU Dam |
| Ruby Horsethief Reach | RMI 124.8-152.5 | Westwater Wash to Loma |
| Westwater Reach | RMI 111.1-124.7 | Above Cisco Launch to below Westwater Wash |
| Lower CO River Reach | RMI 0.0-111.0 | Green River Confluence to Cisco Launch |

| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|---|--|----------------------------|
| 22-Oct | BT | 1 | Unknown | 2021 | MUMMA Stock | Upper CO River Reach |
| 22-Oct | BT | 1 | Unknown | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 22-Oct | BT | 6 | Unknown | 2022 | MUMMA Stock | Upper CO River Reach |
| 22-Oct | RT | 1 | Unknown | 2021 | Westwater HB Est. | Westwater Reach |
| 22-Oct | RZ | 7 | Unknown | 2014(n=1), 2017(n=1), 2018(n=1), 2019(n=1), 2020 (n=2), 2022(n=1) | ONFH-GJ Stock | Upper CO River Reach |
| 22-Oct | UNKNOWN | 1 | Unknown | ?? | Initial Tagging encounter not in STreaMS | ?? |
| 22-Nov | BT | 17 | Unknown | 2021(n=1), 2022(n=16) | ONFH-GJ Stock | Upper CO River Reach |
| 22-Nov | BT | 4 | Unknown | 2022 | ONFH-GJ Stock | Grand Valley Reach |
| 22-Nov | BT | 39 | Unknown | 2022 | MUMMA Stock | Upper CO River Reach |
| 22-Nov | FM | 1 | Unknown | 2021 | Canal Salvage | Grand Valley Reach |
| 22-Nov | FM | 1 | Downstream | 2021 | Canal Salvage | Grand Valley Reach |
| 22-Nov | RT | 2 | Unknown | 2017 & 2019 | Black Rocks HB Est | Ruby Horsethief Reach |
| 22-Nov | RT | 1 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |

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| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|--|--|---|
| 22-Nov | RZ | 1 | Unknown | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 22-Nov | UNKNOWN | 2 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 22-Dec | BH | 1 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 22-Dec | UNKNOWN | 2 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Jan | BT | 1 | Unknown | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Jan | BT | 1 | Unknown | 2022 | MUMMA Stock | Upper CO River Reach |
| 23-Jan | RZ | 1 | Unknown | 2020 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Feb | RZ | 1 | Unknown | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Mar | RZ | 1 | Unknown | 2021 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Apr | BH | 2 | Unknown | 2018 | CPW 3-Spp | ?? |
| 23-Apr | BH | 2 | Unknown | 2021 | Canal Salvage | Grand Valley Reach |
| 23-Apr | BH | 5 | Unknown | 2021 | CPW 3-Spp | Grand Valley Reach |
| 23-Apr | FB | 1 | Unknown | 2018 | CPW 3-Spp | ?? |
| 23-Apr | FM | 67 | Unknown | 2014(n=13), 2016(n=7), 2018(n=17), 2019(n=2), 2021(n=28) | CPW 3-Spp | Grand Valley Reach(n=64), Upper Colorado Reach(n=3) |
| 23-Apr | FM | 14 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 23-Apr | FM | 1 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Apr | RT | 3 | Unknown | 2017, 2020, 2021 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Apr | RT | 1 | Unknown | 2017 | CPW 3-Spp | Upper CO River Reach |

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| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|---|--|----------------------------|
| 23-Apr | RT | 1 | Unknown | 2017 | CO NNF | Lower CO River Reach |
| 23-Apr | RT | 3 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 23-Apr | RT | 2 | Unknown | ?? | Initial Tagging encounter not in STReAMS | ?? |
| 23-Apr | RZ | 11 | Unknown | 2017(n=1), 2019(n=1), 2021(n=2), 2022(n=7) | ONFH-GJ Stock | Upper CO River Reach |
| 23-Apr | UNKNOWN | 57 | Unknown | ?? | Initial Tagging encounter not in STReAMS | ?? |
| 23-May | FM | 4 | Unknown | 2014(n=1), 2021(n=3) | CPW 3-Spp | Grand Valley Reach |
| 23-May | FM | 2 | Unknown | 2019, 2021 | Canal Salvage | Grand Valley Reach |
| 23-May | RZ | 1 | Upstream | 2019 | ONFH-GJ Stock | Upper CO River Reach |
| 23-May | RZ | 12 | Unknown | 2019(n=2), 2021(n=1), 2022(n=9) | ONFH-GJ Stock | Upper CO River Reach |
| 23-May | UNKNOWN | 6 | Unknown | ?? | Initial Tagging encounter not in STReAMS | ?? |
| 23-May | UNKNOWN | 1 | Downstream | ?? | Initial Tagging encounter not in STReAMS | ?? |
| 23-Jun | BH | 2 | Upstream | 2016, 2018 | CPW 3-Spp | Grand Valley Reach |
| 23-Jun | BH | 7 | Unknown | 2018(n=4), 2021(n=3) | CPW 3-Spp | Grand Valley Reach |
| 23-Jun | BH | 2 | Unknown | 2021 | Canal Salvage | Grand Valley Reach |
| 23-Jun | FB | 2 | Unknown | 2018, 2021 | CPW 3-Spp | Grand Valley Reach |
| 23-Jun | FM | 2 | Upstream | 2014 | CPW 3-Spp | Grand Valley Reach |
| 23-Jun | FM | 24 | Unknown | 2014(n=1), 2016(n=2), 2018(n=8), 2019(n=1), 2021(n=11), 2022(n=1) | CPW 3-Spp | Grand Valley Reach |
| 23-Jun | RT | 1 | Unknown | 2021 | Canal Salvage | Grand Valley Reach |

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|---|--|----------------------------|
| 23-Jun | RT | 2 | Unknown | 2017, 2020 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Jun | FM | 1 | Downstream | 2014 | CPW 3-Spp | Grand Valley Reach |
| 23-Jun | FM | 4 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 23-Jun | RT | 2 | Upstream | 2020, 2021 | Westwater HB Est. | Westwater Reach |
| 23-Jun | RT | 1 | Downstream | 2021 | Westwater HB Est. | Westwater Reach |
| 23-Jun | RT | 1 | Downstream | 2021 | Canal Salvage | Grand Valley Reach |
| 23-Jun | RZ | 14 | Unknown | 2014(n=1), 2017(n=1), 2020(n=3), 2021(n=2), 2022 (n=4), 2023(n=3) | ONFH-GJ Stock | Upper CO River Reach |
| 23-Jun | UNKNOWN | 23 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Jun | UNKNOWN | 3 | Downstream | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Jul | BH | 2 | Upstream | 2021 | CPW 3-Spp | Grand Valley Reach |
| 23-Jul | BH | 1 | Unknown | 2021 | CPW 3-Spp | Grand Valley Reach |
| 23-Jul | BH | 1 | Unknown | 2021 | CPW 3-Spp | Upper CO River Reach |
| 23-Jul | BH | 4 | Unknown | 2019, 2021 | Canal Salvage | Grand Valley Reach |
| 23-Jul | BH | 1 | Downstream | 2021 | Canal Salvage | Grand Valley Reach |
| 23-Jul | BT | 1 | Unknown | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Jul | FM | 1 | Unknown | 2018 | CPW 3-Spp | ?? |
| 23-Jul | FM | 1 | Upstream | 2021 | CPW 3-Spp | Upper CO River Reach |
| 23-Jul | FM | 1 | Unknown | 2021 | CPW 3-Spp | Upper CO River Reach |
| 23-Jul | FM | 1 | Upstream | 2021 | Canal Salvage | Grand Valley Reach |

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|------------------------|--|----------------------------|
| 23-Jul | FM | 4 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 23-Jul | RT | 4 | Upstream | 2017, 2020, 2021 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Jul | RT | 7 | Unknown | 2017, 2020, 2021 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Jul | RT | 1 | Downstream | 2016 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Jul | RT | 3 | Upstream | 2020, 2021 | Westwater HB Est. | Westwater Reach |
| 23-Jul | RT | 3 | Unknown | 2020, 2021 | Westwater HB Est. | Westwater Reach |
| 23-Jul | RT | 2 | Upstream | 2019, 2021 | Canal Salvage | Grand Valley Reach |
| 23-Jul | RT | 1 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 23-Jul | RT | 1 | Upstream | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Jul | RZ | 1 | Unknown | 2016 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Jul | UNKNOWN | 12 | Upstream | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Jul | UNKNOWN | 28 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Jul | UNKNOWN | 4 | Downstream | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Aug | BT | 1 | Upstream | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Aug | BT | 2 | Unknown | 2022 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Aug | CH | 1 | Downstream | 2020 | Westwater HB Est. | Westwater Reach |
| 23-Aug | CPM | 1 | Unknown | 2015 | CO CPM | Lower CO River Reach |

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|---|--|----------------------------|
| 23-Aug | CPM | 1 | Unknown | 2016 | CO NNF | Grand Valley Reach |
| 23-Aug | CPM | 1 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Aug | RT | 4 | Unknown | 2020, 2021 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Aug | RT | 1 | Downstream | 2020 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Aug | RT | 2 | Unknown | 2020, 2021 | Westwater HB Est. | Westwater Reach |
| 23-Aug | RT | 1 | Downstream | 2021 | Westwater HB Est. | Westwater Reach |
| 23-Aug | RT | 1 | Unknown | 2021 | Canal Salvage | Grand Valley Reach |
| 23-Aug | RZ | 1 | Upstream | 2020 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Aug | RZ | 16 | Unknown | 2012(n=1), 2015(n=1), 2016(n=2), 2017(n=1), 2018(n=1), 2020(n=3), 2021(n=7) | ONFH-GJ Stock | Upper CO River Reach |
| 23-Aug | RZ | 1 | Downstream | 2016 | ONFH-GJ Stock | Upper CO River Reach |
| 23-Aug | RZ | 2 | Unknown | 2020, 2022 | ONFH-GJ Stock | Gunnison River at Delta |
| 23-Aug | UNKNOWN | 2 | Upstream | ?? | Initial Tagging encounter not in STReaMS | Grand Valley Reach |
| 23-Aug | UNKNOWN | 13 | Unknown | ?? | Initial Tagging encounter not in STReaMS | Grand Valley Reach |
| 23-Sep | BH | 1 | Upstream | 2021 | CPW 3-Spp | Grand Valley Reach |
| 23-Sep | BH | 2 | Unknown | 2021 | CPW 3-Spp | Grand Valley Reach |
| 23-Sep | BH | 1 | Unknown | 2021 | Canal Salvage | Grand Valley reach |
| 23-Sep | BH | 1 | Downstream | 2021 | Canal Salvage | Grand Valley reach |

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

| Month/Year Detected | Spp. | N | Direction Through Ladder | Initial Encounter Year | Initial Encounter Project | Initial Encounter Location |
|---------------------|---------|----|--------------------------|---|--|----------------------------|
| 23-Sep | CPM | 1 | Unknown | 2017 | CO NNF | Lower CO River Reach |
| 23-Sep | CPM | 1 | Unknown | 1991 | CO CPM | Grand Valley Reach |
| 23-Sep | CPM | 1 | Unknown | 2020 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Sep | FM | 2 | Unknown | 2014, 2016 | CPW 3-Spp | Grand Valley Reach |
| 23-Sep | FM | 1 | Unknown | 2019 | CPW 3-Spp | Upper CO River Reach |
| 23-Sep | RT | 1 | Unknown | 2019 | Canal Salvage | Grand Valley Reach |
| 23-Sep | RT | 6 | Unknown | 2020, 2021 | Black Rocks HB Est | Ruby Horsethief Reach |
| 23-Sep | RT | 5 | Unknown | 2011, 2020, 2021 | Westwater HB Est. | Westwater Reach |
| 23-Sep | RT | 1 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Sep | RZ | 3 | Unknown | 2016(n=1), 2019(n=1), 2020(n=1), 2022(n=1), 2023(n=1) | ONFH-GJ Stock | Upper CO River Reach |
| 23-Sep | UNKNOWN | 21 | Unknown | ?? | Initial Tagging encounter not in STReaMS | ?? |
| 23-Sep | UNKNOWN | 1 | Downstream | ?? | Initial Tagging encounter not in STReaMS | ?? |

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

Table 6.

Price-Stubb Fiscal Year Individual PIT Antenna Detections

| Species | BH | BT | CH | CS | FB | FM | HB | RT | RZ |
|--------------------------------|------------|---|----------|-----------|-----------|--------------|----------|------------|--------------|
| # of Individuals FY2010*** | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 6 | 0 |
| # of Individuals FY2011** | 0 | 16 | 0 | 1 | 0 | 1 | 0 | 19 | 83 |
| # of Individuals FY2012** | 0 | 88 | 0 | 8 | 0 | 3 | 1 | 36 | 135 |
| # of Individuals FY2013** | 0 | 138 | 0 | 2 | 0 | 1 | 0 | 79 | 239 |
| # of Individuals FY2014** | 0 | 114 | 0 | 3 | 0 | 1 | 0 | 29 | 69 |
| # of Individuals FY2015** | 106 | 22 | 0 | 4 | 0 | 251 | 0 | 19 | 19 |
| # of Individuals FY2016** | 67 | 126 | 0 | 13 | 0 | 245 | 0 | 21 | 36 |
| # of Individuals FY2017** | 88 | 66 | 0 | 21 | 0 | 103 | 0 | 16 | 140 |
| # of Individuals FY2018** | 70 | 71 | 0 | 11 | 0 | 73 | 0 | 29 | 81 |
| # of Individuals FY2019** | 137 | 176 | 0 | 5 | 4 | 328 | 0 | 28 | 278 |
| # of Individuals FY2020** | 99 | 98 | 1 | 0 | 3 | 474 | 0 | 58 | 142 |
| # of Individuals FY2021** | 42 | 91 | 0 | 2 | 1 | 319 | 0 | 54 | 209 |
| # of Individuals FY2022** | 80 | 77 | 0 | 6 | 3 | 621 | 0 | 130 | 110 |
| # of Individuals FY2023** | 32 | 75 | 1 | 6 | 3 | 127 | 0 | 53 | 75 |
| Grand total¹ | 721 | 1,158 | 2 | 84 | 14 | 2,547 | 1 | 577 | 1,616 |
| | | ¹ Many of these fish were detected at Price-Stubb in multiple years | | | | | | | |
| | | * Antenna was only in operation for 1.5 months during FY 2010 | | | | | | | |
| | | ** Some of these fish were detected in more than one month during the fiscal year | | | | | | | |

Table 7.

Number of individual fish detected by portable submersible antenna (PS) by species for FY 2023 at Government Highline Fish Passage during fish passage operations. Three PS were located in the ladder below the fish trap and one PS was located below the ladder. No PS was in the trap, those fish had to be physically scanned by a PIT tag reader after capture, therefore a “trap only” detection represents a fish that was not detected by other antennas before reaching the trap.

| PS | BT | CPM | RZ | RT | BH | FB | FM | unidentified |
|--------------|----|-----|-----|----|----|----|----|--------------|
| All 4 + Trap | 1 | 0 | 1 | 1 | - | - | - | - |
| Trap + 3 | 1 | 0 | 9 | 4 | - | - | - | - |
| Trap + 2 | 1 | 2 | 20 | 2 | - | - | - | - |
| Trap + 1 | 0 | 0 | 9 | 0 | - | - | - | - |
| Trap Only | 1 | 1 | 7 | 2 | - | - | - | - |
| Below Ladder | 3 | 4 | 108 | 30 | 14 | 1 | 68 | 115 |

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

Table 8.

Number of individual fish detected each month in FY 2023 by the lower PS at Government Highline Fish Passage when the ladder was not in operation. Each month represents individual fish, individuals can be represented in multiple months.

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | Sept |
|---------------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| bonytail | 5 | 24 | 0 | 0 | 1 | 0 | 0 | 0 |
| flannelmouth sucker | 3 | 1 | 0 | 0 | 0 | 0 | 3 | 0 |
| razorback sucker | 26 | 0 | 0 | 2 | 0 | 0 | 4 | 1 |
| roundtail chub | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 3 |
| unidentified | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| Grand Total | 40 | 31 | 0 | 2 | 1 | 0 | 7 | 9 |