

I. Project Title: **Annual Operation and Maintenance of the Fish Passage Structure at the Redlands Diversion Dam on the Gunnison River**

II. Bureau of Reclamation Agreement Number(s): R15PG00083

Project/Grant Period: Start date (Mo/Day/Yr): 10/1/2014
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Is this the final report? Yes _____ No X

III. Principal Investigator(s): Travis Francis, Fish Biologist
U.S. Fish and Wildlife Service
Grand Junction FWCO
445 West Gunnison Ave., Suite 140
Grand Junction, Colorado 81501
Phone: (970) 628-7204
Fax: (970) 628-7217
Email: travis_francis@fws.gov

IV. Abstract: The purpose of this project is to collect and summarize annual data on the number of large-bodied fish, fish species, and seasonal distribution of fish that use the fish passageway at the Redlands Water and Power diversion dam on the Gunnison River. In 2018, the Redlands fish passageway was operational from 18 April to 27 September. This is the twenty-third year that the Redlands fish passageway has been operated since it was completed in late June of 1996.

V. Study Schedule: 1996-Ongoing

VI. Relationship to RIPRAP:
Colorado River Action Plan
Gunnison River

II.B.1.c. Operate and maintain fish ladder.

II.B.1.d. Monitor and evaluate success.

VII. Accomplishment of FY 2018 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Fish Passage

1. A new annual record for this facility occurred this year with 39 Colorado pikeminnow (*Ptychocheilus lucius*) captured in the Redlands fish passage during 2018 (Appendix; Table 1 & 2). The 39 fish had total lengths ranging

from 346 to 664 mm with a mean of 512 mm. Twenty-one were new fish implanted with 134 khz PIT tags the Redlands fish passage in 2018. Unfortunately, a mortality was found in the fish trap which had never been tagged. The remaining 17 were recaptures from previous studies tagged between 2013-2017 (eight were re-encountered prior to fish trap capture). Three made use of the fish ladder in previous years. Fifteen of those recaptured Colorado pikeminnow were tagged in the Colorado River. Two recaptured Colorado pikeminnow were initially tagged in the lower Green River. All 38 alive Colorado pikeminnow were translocated to the Gunnison River at Escalante at river mile (RMI) 42.7 (n=31), Delta RMI 57.0 (n=6), or Bridgeport RMI 29.1 (n=1). The total number of Colorado pikeminnow capture events recorded at the Redlands fish passage from 1996 through 2018 is 226 (Appendix; Table 3).

2. Two razorback sucker (*Xyrauchen texanus*) were captured in the Redlands fish passage during 2018 (Appendix; Table 1 & 2). The total length of these fish were 445 and 450 mm. Both fish were stocked near Delta, Colorado at Gunnison RMI 57.1 in 2016. The total number of razorback sucker capture events recorded at the Redlands fish passage from 1996 through 2017 is 38 (Appendix; Table 3).
3. Eight bonytail (*Gila elegans*) were captured in the Redlands fish passage during 2018 (Appendix; Table 1 & 2). The total lengths of these fish ranged from 281 to 336 mm. Seven of these fish were most likely stocked this year as the data is not in STReAMS yet. One was stocked in 2017 at Colorado RMI 183.6 (Riverbend Park in Palisade, Colorado). Six of these bonytail were collected on the same day as Colorado pikeminnow and were translocated to Escalante at RMI 42.7 on the Gunnison River.
4. Fourteen (of the 1,602 found in the fish trap) roundtail chub (*Gila robusta*) were recaptured (previously PIT tagged) in the Redlands fish passage during 2018 (Appendix; Table 1 & 2). Twelve were tagged in Black Rocks and two were tagged in Westwater (both locations are from the Colorado River near the Colorado/Utah state line).
5. A total of 6,635 fish of all species were handled at the Redlands fish passage between 18 April and 27 September 2018. Native fishes composed 82.8% of the total catch in 2018 (the median value for all years of operation; Appendix; Table 4). The total number of all fishes collected in the 20-year operation of the fish trap is 198,405. Overall, native fish account for about 81% of all fish processed during this 23-year period.

The three species that composed the majority of our catch include bluehead sucker (*Catostomus discobolus*; 38.4%), roundtail chub (24.1%) and flannelmouth sucker (*Catostomus latipinnis*; 14.6%). White sucker (*Catostomus commersoni*) and white sucker hybrids combined made up 9.1% of our total catch (Appendix; Table 1).

The number of channel catfish (*Ictalurus punctatus*) collected in 2018 was 205. The three most abundant years for this species were 2006 (n=432), 2013 (n=995), and 2014 (n=1,029). Only four smallmouth bass (*Micropterus dolomieu*) were collected and euthanized at the Redlands fish passage in 2018.

The first ever striped bass (*Morone saxatilis*) was collected (and euthanized) at the facility in 2018. This fish total length was 556 mm. Four striped bass were also removed from the Colorado River in 2018 by non-native fish removal crews conducting work for project 126a. Striped bass have been removed from the Colorado River via project 126a in 2012 (n=1), 2013 (n=2) and 2017 (n=3).

5. The second most abundant catch of 25 adult gizzard shad (*Dorosoma cepedianum*; ≥ 180 mm TL) were collected and euthanized in 2018, the most abundant catch year for this species was 2007 (n=43).
6. All fish found in the fish trap were counted and sorted by species. All native fish, as well as nonnative rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), were released upstream of Redlands Diversion Dam. All channel catfish were returned alive to the river immediately downstream from the dam. All other nonnative fish plus hybrid suckers were euthanized and disposed of according to protocols specified in our state collecting permit.

Operation and Maintenance

Redlands Fish Passage:

1. Some manual effort (shovels and high pressure hose) and closing the attraction flow head gate (for a rather long period of time) was necessary to remove sediment and debris in the upstream forebay of the Redlands fish passage. In some years (not in 2018), during mid-June immediately following runoff, sediment removal is necessary with the assistance of the Redlands Water and Power Companies backhoe.
2. Annual weed control was continued throughout 2018.
3. Uncertain funding for FY2019 necessitated letting seasonal staff go a month and a half early. The reduction in staff forced us to close the fish ladder 22 days earlier than typical years.

VIII. Additional noteworthy observations:

- A. After 23 years of operation there have been 226 captures of 201 individual Colorado pikeminnow. Twenty-five (12%) of those fish are repeat users of the facility, 19 were re-encountered in a future year and 6 were re-encountered during the same year. We began translocating Colorado pikeminnow further upstream in 2015, to hopefully aid in long term retention of fish in the Gunnison River. Prior to this operational change, only one Colorado pikeminnow was re-encountered in the Gunnison River above Redlands Dam in a future year (after making passage). This fish made passage in

1998, was collected at Gunnison RMI 8.2 in 1999, and was collected again in the Gunnison River at RMI 25.3 in 2000. This same fish was collected in 2001 in the Green River only to return and be re-encountered in the Colorado River in each year of 2003-2005. Even after implementing translocation of fish in 2015, only the previously mentioned fish has been re-encountered in the Gunnison River above the Dam during a future year. However, 135 (67%) of the fish that have made passage have not been re-encountered and some of these fish may have retained in the Gunnison River above Redlands Dam evading detection. Only two electrofishing passes occur each year for project 163 (Gunnison River Fish Community Monitoring) since 2011, and only one antenna array (deployed and managed by Kevin Thompson, Colorado Parks and Wildlife) is in the system in Roubideau Creek. Therefore, evading detection or capture is possible. Additional future encounter data for Colorado pikeminnow that made passage at Redlands Fish Passage can be found in Figure 1. All the above is data from STReaMS collected 11 October, 2018.

- B. Ben Schleicher, a San Juan Biologist in our office, wanted to investigate passage use by available PIT tagged fish by deploying submersible PIT antenna (PIA) at the bottom of the Redlands Fish Ladder and one just before the fish trap at the top end of the ladder. Researchers working with the San Juan River Basin Recovery Implementation Program determined that the Public Service Company of New Mexico Fish Passage Facility was only passing a small percentage of available PIT tagged fish utilizing this same methodology. However, there were no other studies on other fish passage facilities to compare passage rates and determine if there is a design flaw at the San Juan Facility or if there are spatial or temporal explanations for their results. Unfortunately, there were gear limitations realized through this experiment. The PIA deployed have a three-meter diameter and a read range of about 30 inches in a “noise” free environment (free of metals that disrupt the antenna’s ability to energize the passive tag for reading). These dimensions do not allow for complete coverage of the ladder. In addition, Redlands Fish Passage’s structure is constructed of concrete reinforced with steel rebar and all of the baffles and additional equipment is made of aluminum and/or stainless steel all of which create a “noisy” environment (a reduction in read range) for PIT tag detection. Therefore, the results from this “extra” research are inconclusive. Fish made it to the trap and made passage that were not detected by either PIA, and fish were detected that may not have made passage (most of the fish detected were roundtail chub which are supposed to be checked by the ladder operator for a PIT tag – but this research suggests there may be human error). The PIA were deployed from the 29th of April to the 7th of September and detected five unique roundtail chub, two bonytail, one Colorado pikeminnow, two tags that were distributed to Ouray National Fish Hatchery Grand Valley Unit, one tag that was distributed to Brian Hines with Utah Division of Wildlife Resources Moab, and one tag that was not distributed by the program. Only two of these tags were detected on both the upper and lower PIA (and were not collected in the trap, belonging to an unknown tagged fish and a roundtail chub). Two bonytail and one Colorado pikeminnow were detected on the lower PIA (not detected on the upper PIA) and were collected in the trap.

IX. Recommendations:

- A. Biological: Continue to collect information on the number of fish, by species, in the fish trap of the Redlands Dam fish passageway in 2019 starting about 15 April and running through mid-October. Consider FLOY-tagging some of the native three species of concern (roundtail chub, flannelmouth sucker, and bluehead sucker) to determine the number of fish that are re-using the ladder per annum and are being counted more than once in the annual tally.

Continue translocation of Colorado pikeminnow collected in the Redlands fish passage to release points farther upstream in the Gunnison River, in an effort to encourage long-term retention of these fish in the main stem Gunnison River.

- B. Operation and Maintenance: Continue with annual grounds and facility maintenance in 2019.

X. Project Status: “On track and ongoing”.

XI. FY 2018 Budget Status

- A. Funds Provided: \$82,246
- B. Funds Expended: \$82,246
- C. Difference: -0-
- D. Percent of the FY 2018 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission (Where applicable): 2018 data has been uploaded into STReaMS.

XIII. Signed: Travis Francis 10/11/2018
Principal Investigator Date

APPENDIX:

Table 1. Total number of juvenile and adult fish captured in the fish trap of the passageway at the Redlands Diversion Dam from 18 April to 27 September 2018.

Common Name	Number of Fish	Percent of Total Fish
NATIVE FISH		
bluehead sucker	2,550	38.43
bonytail	8	0.12
Colorado pikeminnow	39	0.59
Colorado cutthroat	0	0.00
flannelmouth sucker	966	14.56
<i>Gila</i> both roundtail and humpback traits	0	0.00
Young of year <i>Gila</i>	1	0.02
humpback chub	0	0.00
mountain whitefish	0	0.00
razorback sucker	2	0.03
roundtail chub	1,602	24.14
speckled dace	313	4.72
TOTAL	5,481	82.61
NONNATIVE FISH		
black bullhead	24	0.36
black crappie	0	0.00
blue gill	2	0.03
brook trout	0	0.00
brown trout	99	1.49
channel catfish	205	3.09
common carp	111	1.67
fathead minnow	2	0.03
green sunfish	20	0.30
gizzard shad	25	0.38
largemouth bass	22	0.33
longnose sucker	14	0.21
northern pike	0	0.00
rainbow trout	2	0.03
red shiner	7	0.11
smallmouth bass	4	0.06
sand shiner	0	0.00
splake	0	0.00
striped bass	1	0.02
white sucker	216	3.26
yellow bullhead	0	0.00
TOTAL	754	11.36
HYBRID FISHES		
Native X Native Hybrids:		
razorback X flannelmouth sucker	0	0.00
bluehead X flannelmouth sucker	11	0.17
Native X Nonnative Hybrids:		
bluehead X white sucker	162	2.44
flannelmouth X white sucker	226	3.41
flannelmouth X bluehead X white sucker	1	0.02
bluehead X longnose sucker	0	0.00
flannelmouth X longnose sucker	0	0.00
white X longnose sucker	0	0.00
ALL TOTALS	6,635	100.00

Table 2. 2018 PIT tagged fish histories.

Month of Passage	Species	PIT Tag Histories
Apr-18	roundtail chub (<i>Gila robusta</i>) N=1	N=1 tagged 2017 at Black Rocks (CO RMI 136)
May-18	roundtail chub (<i>Gila robusta</i>) N=10	N=7 tagged 2017 at Black Rocks (CO RMI 136) N=1 tagged 2016 at Black Rocks (CO RMI 136) N=1 tag distributed to Francis GJFWCO 9/6/2012 N=1 tag distributed to Hines UDWR-M 1/10/2017
Jun-18	Colorado pikeminnow (<i>Ptychocheilus lucius</i>) N=3	N=1 tagged at Redlands passage in 2018 N=1 tagged 6/22/2016 at CO RMI 59.8 N=1 tagged 10/29/2014 at CO RMI 53.9, detected 5/25/2017 at Rio Mesa Center PIT antenna (Dolores River)
	roundtail chub (<i>Gila robusta</i>) N=1	N=1 tagged 2017 at Black Rocks (CO RMI 136)
Jul-18	bonytail (<i>Gila elegans</i>) N=7	N=6 Data not in STReAMS, yet. N=1 stocked 7/12/2017 at CO RMI 183.6
	Colorado pikeminnow (<i>Ptychocheilus lucius</i>) N=27	N=1 Mort in trap N=14 tagged at Redlands passage in 2018 N=1 tagged 10/9/2014 at CO RMI 52.4, recaptured 4/9/2015 at CO RMI 57.8, recaptured 4/12/2016 at CO RMI 58.6 N=1 tagged 5/3/2017 at CO RMI 49.2 N=1 tagged 3/26/2015 at CO RMI 62.3, recaptured 10/20/2015 at CO RMI 58.6 N=1 tagged 4/10/2015 at CO RMI 71, recaptured 7/29/2016 at Redlands Fish Passage (GU RMI 3.0) and translocated the same day to Escalante (GU RMI 42.7) N=1 tagged 5/13/2014 at CO RMI 31.5, recaptured 6/22/2016 at CO RMI 54.3 N=1 tagged 10/2/2014 at CO RMI 104.1, recaptured 10/3/2014 at CO RMI 104.1, detected 8/20/2017 at Price Stubb Antenna (CO RMI 188.3) N=1 tagged 6/5/2015 at CO RMI 52.7 N=1 tagged 6/17/2014 at CO RMI 26.5 N=1 tagged 6/14/2016 at GR RMI 29 N=1 tagged 5/30/2016 at GR RMI 8.0 N=1 tagged 10/9/2014 at CO RMI 47.2 N=1 tagged 10/14/2015 CO RMI 57.0
	roundtail chub (<i>Gila robusta</i>) N=1	N=1 tagged 2017 at Black Rocks (CO RMI 136)

Table 2. Continued.

Month of Passage	Species	PIT Tag Histories
Aug-18	bonytail (<i>Gila elegans</i>) N=1	N=1 Data not in STReaMS, yet.
	Colorado pikeminnow (<i>Ptychocheilus lucius</i>) N=9	N=6 tagged at Redlands passage in 2018 N=1 tagged 6/2/2015 at CO RMI 160.2, recaptured 8/11/2015 at Redlands passage (GU RMI 3.0) and translocated the same day to Delta (GU RMI 57.1) N=1 tagged 6/5/2013 at CO RMI 23.6 N=1 tagged 4/10/2015 at CO RMI 66.8, detected 11/12/2015 at Rio Mesa Center PIT antenna (Dolores River), recaptured 4/12/2016 at CO RMI 63.4, recaptured 6/22/2016 at CO RMI 55.4, recaptured 7/18/2017 at Redlands passage (GU RMI 3.0) and translocated the same day to Escalante (GU RMI 42.7), detected 7/22/2017 on CPW Roubideau creek PIT antenna
	razorback sucker (<i>Xyrauchen texanus</i>) N=2	N=1 stocked 8/30/2016 at GU RMI 57.1, recaptured 9/5/2017 at CO RMI 173.1 N=1 stocked 9/13/2016 at GU RMI 57.1
	roundtail chub (<i>Gila robusta</i>) N=1	N=1 tagged 9/12/2016 at Westwater (CO RMI 123.5)

Table 3. Number of Colorado pikeminnow, razorback sucker, and bonytail capture events (not individuals) in the fish trap of the Redlands passageway between 1996 and 2018.

Year	Colorado pikeminnow	Razorback sucker	Bonytail ^a	Humpback chub
1996	1	0	0	0
1997	18	0	0	0
1998	23	0	0	0
1999	5	0	0	0
2000	4	0	0	0
2001	1	5	0	0
2002	7	1	0	0
2003	3	0	1	0
2004	5	3	0	0
2005	4	6	0	0
2006	10	5	0	0
2007	21	4	0	0
2008	0	1	0	0
2009	2	1	0	0
2010	4	1	0	1 ^b
2011	2	1	7	0
2012	12	0	0	0
2013	2	1	0	0
2014	17	2	5	0
2015	6	3	44	0
2016	33	1	33	0
2017	7	1	2	2 ^c
2018	39	2	8	0
Totals	226	38	100	3

^a all bonytail captured in the fish trap were from fish originally stocked in the Colorado and Gunnison rivers.

^b wild fish originally PIT tagged at the head end of Westwater Canyon on the Colorado River (river mile 123.4), 10/07/2008 by Utah DWR.

^c one fish was identified as *Gila* having traits of both humpback and roundtail chub

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 Redlands passageway between 1996 and 2018.

<u>Year</u>	<u>Total Number of Fish</u>	<u>Total Native</u>	<u>Total Nonnative</u>	<u>Percent Composition</u>	
				<u>Native Fishes</u>	<u>Nonnative Fishes</u>
1996	8,375	7,885	490	93.9	6.1
1997	12,233	11,547	686	94.4	5.6
1998	7,589	7,060	529	92.8	7.2
1999	8,264	7,654	610	92.6	7.4
2000	6,662	6,157	505	92.3	7.7
2001	6,317	5,221	1,096	82.6	17.4
2002	4,454	2,956	1,498	66.3	33.7
2003	7,259	4,909	2,350	67.6	32.4
2004	11,720	9,011	2,709	76.9	23.1
2005	11,403	8,414	2,989	73.8	26.2
2006	11,095	9,384	1,711	84.5	15.5
2007	6,963	5,801	1,162	83.4	16.6
2008	3,699	2,818	881	76.2	23.8
2009	3,580	3,066	514	85.6	14.4
2010	6,708	5,805	903	86.5	13.5
2011	8,705	7,087	1,618	81.1	18.9
2012	11,570	10,249	1,321	88.6	11.4
2013	16,687	13,810	2,877	82.8	17.2
2014	13,331	9,046	4,285	67.8	32.2
2015	7,467	5,429	2,038	72.7	27.3
2016	10,347	7,486	2,861	72.4	27.6
2017	7,342	5,251	2,091	71.5	28.5
2018	6,635	5,492	1,143	82.8	17.2
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Totals	198,405	161,538	36,867	81.4	18.6

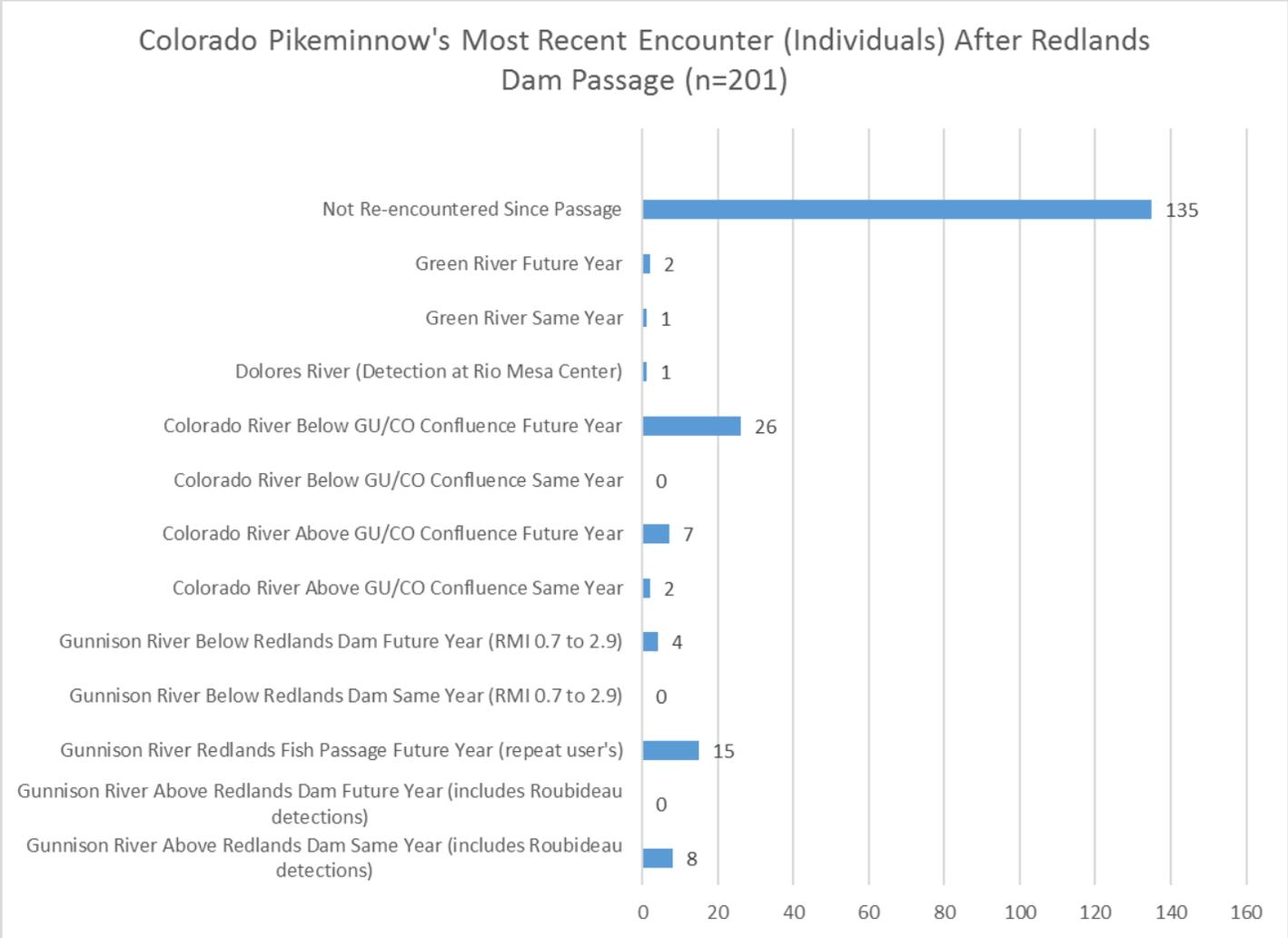


Figure 1. Most Recent Encounter Locations of Colorado Pikeminnow after Passage at Redlands Fish Ladder 1996-2018. Data from STReAMS 20181011.