

I. 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**

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

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IV. Abstract: The purpose of this project is to collect and summarize annual data on the number of large-bodied fish, different fish species, and seasonal distribution of fish that use the fish passageway at the Government Highline diversion dam (aka Grand Valley Water Users [GVWU] dam) on the upper Colorado River in Debeque Canyon. This fish passage structure has been operated during 11 of the last 13 years (construction was completed in August 2004).

A total of 13,581 fish used this fish passage, over a 183-day period, in 2017. This is the fifth highest total ever documented for this fish passage facility. One hundred thirty endangered razorback sucker (*Xyrauchen texanus*, {the highest annual total to ever make passage}) and twelve bonytail (*Gila elegans*) were collected in 2017. This is the first year that two Colorado pikeminnow (*Ptychocheilus lucius*) were documented using this fish passage. Two humpback chub (*Gila cypha*) also made passage (this brings the total to five since the passage began operation).

V. Study Schedule: 2004-Ongoing

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

II.B.3.a (4). Operate, monitor, and evaluate the success of fish passage at Government Highline Diversion Dam.

VII. Accomplishment of FY 2017 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

GVWU Fish Passage

1. In 2017, 130 razorback sucker were collected in the Government Highline fish trap (Appendix; Tables 1, 2 and 3). These fish ranged in total length from 310 to 505 mm with a mean of 389 mm. Six of these fish have become frequent users of this facility making passage in prior years from one to three times.
2. Twelve bonytail made passage in 2017 (Appendix; Tables 1, 2 and 3). These fish ranged in total length from 224 to 402 mm with a mean of 323 mm. Most notable of these fish were two individuals stocked in 2015 that had survived in the wild for two over-winter periods. Two other bonytail stocked in 2016 had survived for one over-winter period.
3. The fourth and fifth ever Colorado pikeminnow made passage at Government Highline Dam in 2017 (Appendix; Tables 1, 2 and 3). These fish had total lengths of 534 and 720 mm. The smaller of the two was tagged on this encounter and the other was originally tagged in 1993 near Westwater Ranger Station at Colorado River mile 128. This fish had additional encounters in the Grand Valley in 1998, 2009, 2013, and 2017. It is estimated (based on size at first PIT-tagging) that this fish is likely a 1982 or 1983 year-class fish.
4. Two humpback chub (*Gila cypha*) also made passage at GVWU passage in 2017 (this brings the total to five since the passage began operation). Their total lengths were identical at 184 mm and both were tagged on this encounter. The first humpback chub to make passage occurred the first year of passage operation (2005) and the other two made passage in 2011.
5. A total of 13,581 fish were collected in the trap of the Government Highline Diversion Dam fish passage from 20 April through the 20 October 2017. This is the fifth highest total ever collected at this fish passage; the highest total in the trap was in 2014 (24,670) and the second highest total was in 2010{(18,390) (Appendix; Table 4)}. This is the eleventh 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, and we would suggest that making specific year-to-year comparisons about yearly catch totals and species composition should be discouraged.

Native fishes (and their hybrid forms) accounted for 83.6% (11,352) of the total catch in 2017 (Appendix; Table 4). Nonnative fishes (and their hybrid forms) accounted for 16.4% (2,229) of the total catch in 2017. Bluehead sucker accounted for 34.3% (4,657) of the total catch and flannelmouth sucker accounted for 33.6% (4,563) of the total catch during 2017 (Appendix; Table 1). These two native species dominated the total catch since the ladder began operation. Roundtail chub accounted for 14% (n = 1,907) of the total catch during 2017. The most prevalent nonnative fish found in the fish trap from 2013 to 2017 was white sucker (4.8% of total catch, n = 657 in 2017; 4.8% of total catch, n = 756 in 2016; 7.5% of total catch, n = 1,075 in 2015; 22.9% of total catch, n = 5,637 in 2014; 14.9% of total catch, n = 1,999 in 2013). Channel catfish, which were not found between Government Highline and Price-Stubbs dams prior to completion of the non-

selective fish passage at Price-Stubb dam in April 2008, were once again collected in the Government Highline fish passage during 2017 (n = 220).

6. Twelve gizzard shad, 19 largemouth bass, and 2 smallmouth bass were also collected and removed in 2017.
7. All fish found in the fish trap were counted and sorted by species. All native fish, as well as nonnative rainbow and brown trout were released upstream of Government Highline 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 produced multiple hits on 712 unique PIT tags during FY 2017 (Table 5), many of these tags were detected on multiple days (n = 2-5). We reported in 2010 (first year of operation) that the close placement of these four antennas in relation to one another (~10 inches apart) complicated determining directionality of fish movements (upstream vs. downstream). In late June of 2011, Audrey Hopkins of Biomark adjusted some of the settings at the unit. She changed the antenna sequence (AS) from 1,2,3,4,0,0,0,0,0,0,0 to 1,3,1,3,1,3,2,4,2,4,2,4 and adjusted the delay time from 100mS to 45mS. These adjustments have provided more resolution for determining directionality of fish movements from detections. Some unknowns still remain, however not as many as were previously encountered. For FY 2017: there were 780 daily detections and 69% (n=535) of those fish passed the antenna heading upstream, 15% (n=113) in an undetermined direction, and 16% (n=132) in a downstream direction. A recurring and problematic issue is that data on many PIT-tagged fish is still not being submitted to STReAMS, 42% (n=301) of the individual tags detected on this antenna array were unknown fish. Bluehead sucker (n=80, *Catostomus discobolus*), bonytail (n=65, *Gila elegans*), Colorado pikeminnow (n=19, *Ptychocheilus lucius*), flannelmouth sucker (n=94, *Catostomus latipinnis*), razorback sucker (n=138, *Xyrauchen texanus*), and roundtail chub (n=14, *Gila robusta*), make up the individual PIT tag detections that could be found in STReAMS (many were detected on multiple dates) during FY 2017. Table 5 gives a detailed breakdown of the fish that were detected by the antenna by month and Table 6 gives annual totals by species.

Operation and Maintenance

1. In 2015, BOR and GVWU employees used a trackhoe to remove a portion of the river left bank and sediment bar that had deposited over numerous years in front of the upstream fish ladder entrance and fish return tube. However, a prolonged spring runoff combined with multiple spring rainstorm spikes in 2015 re-deposited large amounts of sediment and the upstream sediment bar returned, causing the fish return tube to become unusable during low summer and fall flow periods. In spring 2016 and 2017, GVWU opened the roller closest to the fish passage for several weeks during high spring flows to help sluice away the sediment bar. This worked well for about a month after base flows were reached. Unfortunately, multiple rainstorm spikes combined with deposition of sediment due to low, slow flows on the inside bend of the river in summer 2016 and

2017 again re-deposited large amounts of sediment and by late summer 2016 and 2017, the upstream sediment bar had returned. This once again caused the fish return tube to become unusable during low summer base flow periods, due to fish stranding and or impingement issues. Therefore, our employees moved common native fishes (in a stocking truck) approximately 30 yards downstream, releasing them near the opening for the attraction flow gate (downstream of the terminal end of the sediment bar, but closer to the roller dam) for safe release back to the river for most of the 2015 through 2017 field seasons.

In contrast, endangered fishes were transported upstream several hundred yards (again in a stocking truck) where they were released upstream of the sediment bar. This required transferring endangered fish from the stocking truck to the river in hand-held nets through fairly thick vegetation, one at a time, to the river's edge where they could be safely released.

2. Weeds were sprayed and removed from the property throughout 2017.
3. Accumulated debris and trash were manually removed from the Price-Stubb non-selective fish passage facility 5 miles downstream of the Government Highline Fish Passage in early July 2017.

VIII. Additional noteworthy observations: See above

IX. Recommendations:

A. Biological:

1. Continue to collect information on the number of fish, by species, in the fish trap of the Government Highline fish passageway in 2018 starting about 15 April and running through mid-October. These tentative dates may need to be adjusted, based upon the ability of the adjacent Grand Valley Water Users canal, as well as the ability of downstream diversions structures to get sufficient quantities of water to fill their canals.
2. Continue collecting data from Price-Stubb antenna.

B. Operation and Maintenance:

1. In past years it has been stated in this section of our annual report that “to maintain optimum performance of the fish passageway, sediment maintenance should be performed on as-needed basis to remove sediment and debris from the forebay of the fishway and attraction flow intakes to prevent buildup and compaction of sediment.”

It is our opinion that the large, heavily-vegetated portion of the riverbank on river left immediately upstream of and adjacent to the upstream fish ladder openings should at some point be further removed (a much larger section than was removed during the 2015 removal effort) during early spring 2018, just prior to high flows. This heavily-vegetated portion of the river bank now redirects a significant amount of the river flow away from the upstream fish ladder openings and leads to heavy sedimentation in front of the upstream portions of the fish passage. The upstream fish return tube (a 12-inch pipe, immediately adjacent to the entrance of the fish ladder) has become almost impossible to use (even after trackhoe removal in 2015) during low flow periods due to the massive sediment peninsula that keeps rebuilding in front of it.

During low flow periods in 2016 and 2017, native and endangered fish being returned upstream had to be loaded by hand from the concrete fish sorting tanks at the fish ladder into a stock tank in the back of a pickup truck, then driven downstream (to the attraction flow head gate) in order to prevent the fish stranding and/or impingement resulting in probable death that would have resulted had the fish return tube been used on those occasions. Unfortunately, this release site is ~30 yards closer to the dam, increasing the likelihood of fish being swept back downstream. This was stressful on both the fish and the biologists, especially on several days when total numbers of fish being handled in the ladder exceeded 1,000 individuals and ambient air temperatures exceeded 95 degrees.

Having been on-site when similar (smaller volume) sediment removal work was done in 2015 leads us to believe that further vegetation and sediment removal along the heavily-vegetated riverbank could be done from the river left shoreline using a long-reach trackhoe. It's our opinion that such a maintenance activity would help reduce sedimentation problems which occur annually in front of the upstream fish passage opening, fish return tube, and attraction flow opening. Unfortunately, even if this maintenance action is done, the vegetated bank on river left will eventually reform (as it did in one year following the 2015 sediment removal action), as the fish ladder is located on the inside bend of the river, across the river from the GVWU canal head gates, which means that this location will naturally accumulate sediment over time and manual sediment removal will have to be repeated at some point.

During the spring 2014, 2016 and 2017 high flow periods, GVWU opened the roller closest to the fish passage. The natural sluicing action that this action causes is very effective at removing large amounts of sediment from in front of the fish passage in a very short period of time. Unfortunately, the length of time that the fish passage realizes the benefits from this action can be highly variable, depending

upon 1) how low summer base flows are, and 2) how many summer rainstorm events we have. Both circumstances quickly act to re-deposit the sediment bar in front of the fish ladder entrance and return tube. At a bare minimum though, we feel that having GVWU continue to sluice during spring high flow periods by raising the roller closest to the fish passage is critical.

Because of its physical location, on the inside bend of a very wide and slow section of the Colorado River, the area directly in front of the Government Highline fish passage is very susceptible to sedimentation. It is our recommendation that some combination of the two actions specified above take place every spring to help control sedimentation issues. But at the very minimum, we believe the sluicing operations are vital to our ability to continue to successfully operate this structure from mid-April through mid-October each year.

X. Project Status: On track and ongoing

XI. FY 2017 Budget Status

- A. Funds Provided: \$65,047
- B. Funds Expended: \$65,047
- C. Difference: -0-
- D. Percent of the FY 2017 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission (Where applicable): Data will be submitted to UCRRP database manager January 2018.

XIII. Signed: Travis Francis 11/02/2017
Principal Investigator Date

APPENDIX:

Table 1. Total number of juvenile and adult fish captured in the fish trap of the passageway at the Government Highline Diversion Dam during 2017.

<u>Common Name</u>	<u>Number of Fish</u>	<u>Percent of Total Fish</u>
NATIVE FISH		
bluehead sucker	4,657	34.29
bonytail	12	0.09
Colorado pikeminnow	2	0.01
Colorado cutthroat	1	0.01
flannelmouth sucker	4,563	33.60
humpback chub	2	0.01
mountain whitefish	35	0.26
razorback sucker	130	0.96
roundtail chub	1,907	14.04
speckled dace	17	0.13
TOTAL	11,326	83.40
NONNATIVE FISH		
black bullhead	79	0.58
black crappie	1	0.01
blue gill	5	0.04
brook trout	0	0.00
brown trout	226	1.66
channel catfish	220	1.62
common carp	11	0.08
fathead minnow	0	0.00
green sunfish	16	0.12
gizzard shad	12	0.09
largemouth bass	19	0.14
longnose sucker	152	1.12
northern pike	0	0.00
rainbow trout	49	0.36
red shiner	0	0.00
smallmouth bass	2	0.01
splake	0	0.00
white sucker	657	4.84
TOTAL	1449	10.67
HYBRID FISHES		
<u>Native X Native Hybrids:</u>		
razorback X flannelmouth sucker	0	0.00
bluehead X flannelmouth sucker	26	0.19
<u>Native X Nonnative Hybrids:</u>		
bluehead X white sucker	174	1.28
Colorado cutthroat X rainbow trout	3	0.02
flannelmouth X white sucker	603	4.44
bluehead X longnose sucker	0	0.00
flannelmouth X longnose sucker	0	0.00
white X longnose sucker	0	0.00
ALL TOTALS	13,581	100.00

Table 2. 2017 GVWU PIT tagged fish histories.

Month of Passage	Species	PIT Tag Histories
Apr-17	Razorback sucker (<i>Xyrauchen texanus</i>) N=2	N=1 stocked 4/27/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5, detected at Price Stubb 4/12/2017 N=1 stocked 8/31/2016 in Rifle at CO RMI 240.7
May-17	Razorback sucker (<i>Xyrauchen texanus</i>) N=28	N=1 stocked 10/16/2014 in Rifle at CO RMI 240.7, detected at Price Stubb 4/21/2017 N=1 stocked 4/28/2015 in Rifle at CO RMI 240.7, detected at Price Stubb 4/25/2017 N=1 stocked 4/29/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5, made passage at GVWU 7/20/2016 N=6 stocked 8/31/2016 in Rifle at CO RMI 240.7 N=4 stocked 9/8/2016 in Rifle at CO RMI 240.7 N=14 Stock data not in STReAMS, yet N=1 released without use of a PIT tag reader
Jun-17	Bonytail (<i>Gila elegans</i>) N=1	N=1 stocked 8/10/2016 in Debeque Canyon at CO RMI 208.5, detected at Price Stubb 5/29/2017
	Razorback sucker (<i>Xyrauchen texanus</i>) N=5	N=1 tagged at GVWU passage in 2017 N=4 stocked 8/31/2016 in Rifle at CO RMI 240.7
Jul-17	Bonytail (<i>Gila elegans</i>) N=3	N=2 tagged at GVWU passage in 2017 N=1 stocked 8/10/2016 in Debeque Canyon at CO RMI 208.5
	Humpback chub (<i>Gila cypha</i>) N=1	N=1 tagged at GVWU passage in 2017
	Razorback sucker (<i>Xyrauchen texanus</i>) N=63	N=1 tagged at GVWU passage 2017 N=1 with no stock data in STReAMS detected at Price Stubb 7/15 and 7/16/2017 N=1 stocked 10/13/2011 at Hoagland Conservation Easement near Parachute at CO RMI 227.6, given passage at GVWU on 7/17/2014 and 7/25/2016 N=1 stocked 8/29/2013 in Rifle at CO RMI 240.7, given passage at GVWU 7/14/2014, 7/1/2015 and 7/20/2016 N=5 stocked 10/16/2014 in Rifle at CO RMI 240.7, one detected at Price Stubb 7/14/2017 and one detected at Price Stubb 8/8/2016 and given passage at GVWU 8/5/2016 N=1 stocked 4/27/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5, detected at Price Stubb 6/3/2016 and given passage at GVWU 7/19/2016 N=1 missing stock data detected at Price Stubb 8/28/2016 and given passage at GVWU 8/30/2016 N=32 stocked 8/31/2016 in Rifle at CO RMI 240.7, four detected at Price Stubb (n=1 6/1/2017, n=1 6/28/2017, n=1 7/21/2017, n=1 7/25/2017) N=16 stocked 9/8/2016 in Rifle at CO RMI 240.7, one detected at Price Stubb 7/19/2017 N=1 stocked 9/14/2016 in Palisade at CO RMI 185.4 N=1 stocked 10/21/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5 N=2 Stock data not in STReAMS, yet

Table 2. Continued

Month of Passage	Species	PIT Tag Histories
Aug-17	Bonytail (<i>Gila elegans</i>) N=2	N=1 tagged at GVWU passage in 2017 N=1 tagged 9/29/2015 near Moab at CO RMI 55.2 detected at Price Stubb 8/21/2017
	Colorado pikeminnow (<i>Ptychocheilus lucius</i>) N=1	N=1 tagged at GVWU passage in 2017
	Humpback chub (<i>Gila cypha</i>) N=1	N=1 tagged at GVWU passage in 2017
	Razorback sucker (<i>Xyrauchen texanus</i>) N=33	N=1 tagged at GVWU passage 2017 N=2 stocked 10/16/2014 in Rifle at CO RMI 240.7, one given passage at GVWU 8/12/2016 N=1 stocked 7/23/2015 in Fruita at CO RMI 157.1 detected at Price Stubb 8/1/2017 N=1 stocked 4/27/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5 detected at Price Stubb 5/14/2016 and 7/13/2017 N=15 stocked 8/31/2016 in Rifle at CO RMI 240.7, four detected at Price Stubb (n=1 7/20/2017, n=1 6/28/2017, n=1 7/25/2017, n=1 5/17/2017) N=8 stocked 9/8/2016 in Rifle at CO RMI 240.7, one detected at Price Stubb 8/1/2017 N=1 stocked 9/14/2016 in Palisade at CO RMI 185.4 N=1 stocked 10/19/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5 detected at Price Stubb 6/1/2017 N=1 stocked 10/21/2016 near CDOT Pond in Debeque Canyon at CO RMI 204.5, one detected at Price Stubb 7/28/2017 N=1 stocked 5/15/2017 near CDOT Pond in Debeque Canyon at CO RMI 204.5 N=1 Stock data not in STReAMS, yet
Sep-17	Bonytail (<i>Gila elegans</i>) N=4	N=4 stock data not in STReAMS, one detected at Price Stubb 9/6/2017
	Colorado pikeminnow (<i>Ptychocheilus lucius</i>) N=1	N=1 tagged 4/30/1993 near Westwater Ranger Station CO RMI 128, recaptured 8/28/1998 and 5/14 2009 near Palisade, recaptured 4/24/2013 near Fruita and detected at Price Stubb 5/25/2017
	Razorback sucker (<i>Xyrauchen texanus</i>) N=1	N=1 Stock data not in STReAMS, yet
Oct-17	Bonytail (<i>Gila elegans</i>) N=1	N=1 stock data not in STReAMS
	Razorback sucker (<i>Xyrauchen texanus</i>) N=1	N=1 stock data not in STReAMS

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 between 2005 and 2017.

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
Totals	5	247	102	5

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 2016.

Year	Total Number of Fish	Total Native	Total Nonnative	Percent Composition	
				Native Fishes	Nonnative Fishes
2004	fish passageway & fish trap not run due to insufficient flows				
2005	4,638 ^a	2,867	1,771	61.8	38.2
2006	11,978 ^b	10,747	1,231	89.7	10.3
2007	fish passageway run for sediment maintenance only (fish trap not run)				
2008	10,788 ^c	9,663	1,125	89.6	10.4
2009	12,402 ^d	11,286	1,116	91.0	9.0
2010	18,390 ^e	16,358	2,032	89.0	11.0
2011	8,875 ^f	6,870	2,005	77.4	22.6
2012	fish passageway & fish trap not run due to insufficient flows				
2013	13,401 ^g	10,702	2,699	79.9	20.1
2014	24,670 ^h	17,253	7,417	69.9	30.1
2015	14,248 [□]	12,094	2,154	84.9	15.1
2016	15,889 ^j	13,754	2,135	86.6	13.4
2017	13,581 ^k	11,352	2,229	83.6	16.4
Totals	148,860	122,946	25,914	82.6	17.4

^a Fish trap operated for 12 days (June and September).

^b Fish trap operated for 41 days (five, 2-week periods).

^c Fish trap operated continuously from 2 May to 15 October.

^d Fish trap operated continuously from 20 April to 15 October.

^e Fish trap operated continuously from 16 April to 15 October.

^f Fish trap operated continuously from 19 April 19 to 14 October.

^g Fish trap operated for 49 days (continuously from 17 May to 5 July).

^h Fish trap operated for 177 days (continuously from 22 April to 16 October).

□ Fish Trap operated 140 days (continuously from 1 May to 12 August, and again from 9 September to 16 October)

^j Fish Trap operated 136 days (continuously from 25 April to 13 May, again from 16 May to 8 June, again from 9 June to 28 July, and again from 11 August to 14 October)

^k Fish Trap operated continuously from 20 April to 20 October.

Table 5 Price Stubb PIT Antenna Detections

Month of Detection	Direction	Species	Number of Fish	History
October 2016	Upstream	BH	0	N=2 tagged by CPW for 3 Spp. work in Oct. 2014 at CO RMI 175.3
	Unknown		0	
	Downstream		2	
	Upstream	BT	11	N=1 stocked 3/22/2016 at CO RMI 166.7 N=3 stocked 6/30/2016 at CO RMI 183.6; two detected at Price Stubb (n=2 Sept 2016, n=1 Aug 2016) N=14 stocked 7/6-7/2016 at CO RMI 183.6; two detected at Price Stubb (n=2 Sept 2016) N=2 stocked 8/10/2016 at CO RMI 208.5
	Unknown		0	
	Downstream		9	
	Upstream	FM	1	N=1 tagged by CPW for 3 Spp. work in Oct. 2015 at CO RMI 177.7; detected at Price Stubb April and October 2016, April 2017
	Unknown		0	
	Downstream		0	
	Upstream	RZ	2	N=1 stocked August 2016 at CO RMI 240.7 N=5 stocked Sep. 2016 at CO RMI 240.7
	Unknown		1	
	Downstream		3	
	Upstream	RT	1	N=1 Tagged 10/11/2011 at Black Rocks CO RMI 136; detected at Price Stubb multiple times in 2012, 2013, 2014 and 2015 N=1 tagged by CPW for 3 Spp. Work in Oct 2014 at CO RMI 177.7
	Unknown		0	
	Downstream		1	
Upstream	Unidentified	0	N=2 tags distributed to Jenn Logan CPW in 2013 for 3 Spp. Work	
Unknown		0		
Downstream		2		

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
November 2016	Upstream	BT	2	N=5 stocked 6/30/2016 at CO RMI 183.6; four detected at Price Stubb (n=2 Sept 2016, n=2 Aug 2016) N=11 stocked 7/6-7/2016 at CO RMI 183.6; eight detected at Price Stubb (n=2 Aug 2016, n=5 Sept. 2016, n=1 Oct 2016) N=6 stocked 8/10/2016 at CO RMI 208.5
	Unknown		7	
	Downstream		13	
	Upstream	RZ	2	
	Unknown		4	
	Downstream		5	
December 2016 through February 2017	Upstream	BH	0	N=2 tagged by CPW for 3 Spp. work in Oct. 2014 at CO RMI 177.7 two detected at Price Stubb (n=1 April 2015, n=1 June 2016)
	Unknown		2	
	Downstream		0	
	Upstream	BT	0	N=2 stocked 6/30/2016 at CO RMI 188.3; one detected at Price Stubb (n=1 Sept 2016) N=3 stocked 8/10/2016 at CO RMI 208.5
	Unknown		2	
	Downstream		3	
	Upstream	RZ	0	N=1 stocked 10/18/2011 at CO RMI 227.6 N=1 stocked 6/16/2016 at CO RMI 204.5
	Unknown		1	
	Downstream		1	

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
March 2017	Upstream	BH	9	N=10 tagged by CPW for 3 Spp. work in Oct. 2014-2015 between CO RMI 175.3 and 177.7 many were detected multiple times
	Unknown		1	
	Downstream		0	
	Upstream	BT	3	N=1 stocked 6/30/2016 at CO RMI 183.6; one detected at Price Stubb (n=1 Sept 2016) N=4 stocked 7/6-7/2016 at CO RMI 183.6; one detected at Price Stubb (n=1 Sept 2016) N=5 stocked 8/10/2016 at CO RMI 208.5
	Unknown		2	
	Downstream		5	
	Upstream	FM	9	N=10 tagged by CPW for 3 Spp. work in Oct. 2014 between CO RMI 175.3 and 177.7 many were detected multiple times
	Unknown		1	
	Downstream		0	
	Upstream	RZ	0	N=2 stocked 8/31/2016 at CO RMI 240.7 N=2 stocked 9/8/2016 at CO RMI 240.7
	Unknown		4	
	Downstream		0	
	Upstream	RT	1	N=1 tagged 10/11/2011 in Black Rocks at CO RMI 136 detected many times at Price Stubb 2012-2017
	Unknown		0	
	Downstream		0	
Upstream	Unidentified	28	N=8 distributed to Jenn Logan CPW in 2013 or 2014 for 3 Spp. Work; many detected multiple times at Price Stubb 2014-2017 N=21 contain a non-Recovery Program tag	
Unknown		1		
Downstream		0		

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
April 2017	Upstream	BH	35	N=52 tagged by CPW for 3 Spp. work in Oct. 2014-2015 between CO RMI 175.3 and 177.7 many were detected multiple times
	Unknown		7	
	Downstream		5	
	Upstream	CS	2	N=1 tagged 6/20/2006 at GR RMI 29.5, recaptured 5/15/2007 GR RMI 29, detected July and Aug 2016 GR RMI 128.3 (Tusher Diversion), Detected Price Stubb April 2016 N=1 tagged 9/14/2016 at CO RMI 183.1
	Unknown		0	
	Downstream		0	
	Upstream	FM	45	N=55 tagged by CPW for 3 Spp. work in Oct. 2014-2015 between CO RMI 175.3 and 177.7 many were detected multiple times
	Unknown		7	
	Downstream		3	
	Upstream	RZ	11	N=1 stocked 10/14/2010 at CO RMI 227.6 recaptured 5/21/2012 at CO RMI 178 N=1 stocked 8/27/2013 at CO RMI 183.6 recaptured 7/23/2014 at CO RMI 156.4 N=3 stocked 10/16/2014 at CO RMI 240.7, one recaptured 7/20/2016 at CO RMI 193.7 (GVWU Dam) N=1 stocked 4/28/2015 at CO RMI 240.7 N=1 stocked 4/27/2016 at CO RMI 204.5 N=14 stocked 8/31/2016 at CO RMI 240.7 N=4 stocked 9/8/2016 at CO RMI 240.7 N=1 stocked 9/14/2016 at CO RMI 185.4 N=1 stocked 10/19/2016 at CO RMI 204.5
	Unknown		5	
	Downstream		11	

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
April 2017 Cont.	Upstream	Unidentified	154	N=52 distributed to Jenn Logan CPW in 2013 or 2014 for 3 Spp. Work; many detected multiple times at Price Stubb 2014-2017 N=116 contain a non-Recovery Program tag N=2 distributed to Program partners and fish data missing in STReaMS
	Unknown		8	
	Downstream		8	
May 2017	Upstream	BH	17	N=26 tagged by CPW for 3 Spp. work in Oct. 2014-2015 between CO RMI 175.3 and 177.7 many were detected multiple times
	Unknown		0	
	Downstream		9	
	Upstream	BT	4	N=4 stocked 7/6-8/2016 at CO RMI 183.6 N=3 stocked 8/10/2016 at CO RMI 208.5
	Unknown		2	
	Downstream		1	
	Upstream	CS	6	N=1 tagged 4/30/1993 at CO RMI 128 recaptured 8/28/1998 at CO RMI 187.4 and again 5/14/2009 at CO RMI 170.8 and again 4/24/2013 at CO RMI 158.9 N=1 tagged at CO RMI 15.5 recaptured 5/21/2013 at CO RMI 179.2 N=1 tagged 5/13/2013 at CO RMI 27.1 detected at Price Stubb 8/17/2014 and recaptured 4/7/2015 at CO RMI 145.5 N=1 tagged 5/17/2013 at CO RMI 58.2 recaptured 4/9/2015 at CO RMI 55.7 N=1 tagged 5/13/2014 at CO RMI 34 recaptured 8/4/2016 at Redlands Fish Passage (GU RMI 3.0) and transferred to GU RMI 42.7 N=1 tagged 7/21/2014 at Redlands Fish Passage (GU RMI 3.0) N=1 tagged 6/19/2015 at CO RMI 99
	Unknown		1	
	Downstream		0	

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
May 2017 Cont.	Upstream	FM	22	N=33 tagged by CPW for 3 Spp. work in Oct. 2014-2015 between CO RMI 175.3 and 177.7 many were detected multiple times
	Unknown		4	
	Downstream		7	
	Upstream	RZ	19	N=1 stocked 10/21/2010 at CO RMI 227.6 detected at Price Stubb March and May 2015 N=1 stocked 9/24/2012 at CO RMI 183.6 recaptured 4/6/2015 at CO RMI 169.8 detected 10/4/2016 at Black Rocks (CO RMI 134.7) N=1 stocked 10/2/2012 at CO RMI 240.7 detected at Price Stubb August and Oct. 2014 N=2 stocked 9/10/2013 at CO RMI 157.1; one recaptured 4/21/2014 at CO RMI 166.4 N=8 stocked 10/1-3/2014 at CO RMI 183.6; one recaptured 7/2/2015 and 7/11/2016 at CO RMI 155.8, on erecaptured 6/29/2015 and 7/8/2016 between CO RMIs 173-178, one recaptured 7/25/2016 at CO RMI 174.8 N=2 stocked 10/16/2014 at CO RMI 240.7 N=1 stocked 10/22/2014 at GU RMI 57.1 N=1 stocked 4/27/2016 at CO RMI 204.5 N=8 stocked 8/31/2016 at CO RMI 240.7 N=8 stocked 9/8/2016 at CO RMI 240.7 N=1 tagged 7/22/2016 at CO RMI 193.7 (GVWU Dam)
	Unknown		7	
	Downstream		8	

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
May 2017 Cont.	Upstream	RT	2	N=1 tagged 10/27/2011 at Black Rocks (CO RMI 136); detected at Price Stubb May and June 2012 and May 2013 and 2016 N=1 tagged 10/11/2012 at Black Rocks (CO RMI 136); detected at Price Stub in May 2013, 2015, and 2016 N=1 tagged 9/14/2016 in Westwater (Co RMI 121.7)
	Unknown		1	
	Downstream		0	
	Upstream	Unidentified	72	N=18 distributed to Jenn Logan CPW in 2013 or 2014 for 3 Spp. Work; many detected multiple times at Price Stubb 2014-2017 N=89 contain a non-Recovery Program tag N=1 distributed to Program partners and fish data missing in STReAMS
	Unknown		17	
	Downstream		19	
June 2017	Upstream	BH	0	N=1 tagged by CPW for 3 Spp. work in Oct. 2014 at CO RMI 175.3
	Unknown		1	
	Downstream		0	
	Upstream	FM	1	N=2 tagged by CPW for 3 Spp. work in Oct. 2014 at CO RMI 177.7; one detected at Price Stubb May 2015
	Unknown		1	
	Downstream		0	
	Upstream	RZ	6	N=1 stocked 10/3/2014 at CO RMI 183.6 N=1 stocked 10/16/2014 at CO RMI 240.7 N=1 stocked 4/27/2016 at CO RMI 204.5 N=8 stocked Aug through Sept. 2016 at CO RMI 240.7 N=1 stocked 10/19/2016 at CO RMI 204.5 N=4 stocked May through June 2017 at CO RMI 204.5
	Unknown		8	
	Downstream		2	
	Upstream	RT	5	N=1 tagged and recaptured Oct. 2007 in Westwater (CO RMI 121.8) N=2 tagged by CPW for 3 Spp. Work in Oct 2014 at CO RMI 177.7; one detected at Price Stubb May 2016 N=2 tagged Sept or Oct. 2016 in Black Rocks (CO RMI 136)
	Unknown		1	
	Downstream		0	

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
June 2017 Cont.	Upstream	Unidentified	4	N=4 distributed to Jenn Logan CPW in 2013 or 2014 for 3 Spp. Work; many detected multiple times at Price Stubb 2014-2017 N=4 contain a non-Recovery Program tag N=1 distributed to Program partners and fish data missing in STreaMS
	Unknown		3	
	Downstream		2	
July 2017	Upstream	CS	1	N=1 tagged 6/20/2006 at GR RMI 29.5, recaptured 5/15/2007 at GR RMI 29, detected at Price Stubb April 2016, detected at Tusher Diversion (GR RMI 128.3) 7/8-9/2016, detected GR Below Siphon Aug. 2016
	Unknown		0	
	Downstream		0	
	Upstream	FM	1	N=1 tagged by CPW for 3 Spp. work in Oct. 2014 at CO RMI 177.7
	Unknown		0	
	Downstream		0	
	Upstream	RZ	21	N=2 stocked 9/11-12-2013 at CO RMI 240.7, one recaptured Sept. 2015 and Aug. 2016 at CO RMI 193.7 (GVWU Dam), one recaptured 6/29/2015 at CO RMI 193.7 (GVWU Dam) N=1 stocked 10/3/2014 at CO RMI 183.6 N=7 stocked 10/16/2014 at CO RMI 240.7, one recaptured 6/9/2015 at CO RMI 173.4, one recaptured 11/19/2016 in GVIC Canal and transferred to CO RMI 185.1 N=1 stocked 4/28/2015 at CO RMI 240.7 N=1 stocked 4/27/2016 at CO RMI 204.5 N=7 stocked Aug. or Sept. 2016 at CO RMI 240.7; two detected at Price Stubb April 2017 N=3 stocked 9/14/2016 at CO RMI 185.4 N=1 stocked 10/21/2016 at CO RMI 204.5 N=4 stocked April-May 2017 at CO RMI 204.5
	Unknown		5	
	Downstream		1	

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History	
July 2017 Cont.	Upstream	RT	2	N=1 tagged 9/19/2016 at Black Rocks (CO RMI 136) detected at Black Rocks 10/7/2016 N=1 tagged 9/27/2016 at Westwater (CO RMI 121.7)	
	Unknown		0		
	Downstream		0		
	Upstream	Unidentified	2	N=4 distributed to Program partners and fish data missing in STreaMS	
	Unknown		2		
	Downstream		0		
August 2017	Upstream	BT	2	N=1 stocked 7/23/2015 at CO RMI 157.1 N=1 tagged 9/29/2015 at CO RMI 55.2	
	Unknown		0		
	Downstream		0		
	Upstream	CS	8	N=1 tagged 5/26/2005 at CO RMI 171 recaptured June 2009 and 2010 and Sept. 2011 between CO RMIs 170 and 174 N=1 tagged 5/26/2005 at CO RMI 3.5 recaptured 4/17/2008 CO RMI 9, detected at Price Stubb July and Aug. 2012, detected at Tusher Diversion (GR RMI 188.3) June and July 2016 N=1 tagged 6/8/2005 CO RMI 58.3 recaptured 4/21/2014 at CO RMI 161.5, detected at Price Stubb Aug. 2015 N=1 tagged 5/13/2014 at CO RMI 28.5 recaptured 6/8/2016 at CO RMI 90 N=2 tagged Oct. 2014 between CO RMI 105-59, one recaptured 4/12/2016 at CO RMI 60.1 N=1 tagged 6/20/2006 at GR RMI 29.5 recaptured 5/15/2007 at GR RMI 29, detected at Price Stubb April 2016 and May and July 2017, detected at Tusher Diversion (GR RMI 128.3) July 2016, detected at GR canal August 2016 N=2 tagged April 2015 between CO RMI 61-76 N=1 tagged 6/23/2016 at CO RMI 48	
	Unknown		2		
	Downstream		0		

Table 5 cont.

Month of Detection	Direction	Species	Number of Fish	History
August 2017 Cont.	Upstream	FM	0	N=1 tagged by CPW for 3 Spp. work in Oct. 2014 at CO RMI 177.7
	Unknown		0	
	Downstream		1	
	Upstream	RZ	10	N=1 stocked 9/11/2013 at CO RMI 240.7 N=1 stocked 10/3/2014 at CO RMI 183.6 N=2 stocked 10/16/2014 at CO RMI 240.7; one recaptured 5/4/2015 at CO RMI 193.7 and again at Redlands Fish Passage 11/16/2016 then transferred to Escalante (GU RMI 185.1) N=1 stocked 7/15/2015 at CO RMI 204.5 N=2 stocked April 2016 at CO RMI 204.5 N=1 with unknown stock data recaptured 9/1/2016 at CO RMI 178.3 N=1 stocked 9/14/2016 at CO RMI 185.4 N=3 stocked Sept. 2016 at CO RMI 240.7
	Unknown		2	
	Downstream		0	
	Upstream		2	
	Unknown		0	
	Downstream	0		
	Upstream	RT	2	N=2 tagged October 2016 at Black Rocks (CO RMI 136)
	Unknown		0	
	Downstream		0	
	Upstream	Unidentified	1	N=2 contain a non-Recovery Program tag N=1 distributed to Program partners and fish data missing in STReAMS
Unknown	1			
Downstream	1			

Table 5 cont.

September 2017	Upstream	CS	1	N=1 tagged 5/17/2013 at CO RMI 52.6, recaptured 5/2/2014 at CO RMI 52.6, detected at Price Stubb Sept. 2014
	Unknown		0	
	Downstream		0	
	Upstream	RZ	0	N=1 stocked 10/16/2014 at CO RMI 240.7; one recaptured 5/4/2015 at CO RMI 193.7 and again at Redlands Fish Passage 11/16/2016 then transferred to Escalante (GU RMI 185.1) detected at Price Stubb Aug. 2017
	Unknown		0	
	Downstream		1	
	Upstream	Unidentified	9	N=4 contain a non-Recovery Program tag N=16 distributed to Program partners and fish data missing in STReaMS
	Unknown		2	
	Downstream		9	

Table 6 Price Stubb Fiscal Year Monthly PIT Antenna Detections

Species	BH	BT	CS	FM	HB	RT	RZ
# of Individuals FY2010***	0	0	2	0	0	6	0
# of Individuals FY2011**	0	16	1	1	0	19	83
# of Individuals FY2012**	0	88	8	3	1	36	135
# of Individuals FY2013**	0	138	2	1	0	79	239
# of Individuals FY2014**	0	114	3	1	0	29	69
# of Individuals FY2015**	106	22	4	251	0	19	19
# of Individuals FY2016**	67	126	13	245	0	21	36
# of Individuals FY2017**	88	66	21	103	0	16	140
Grand total	261	570	54	605	1	225	721
* 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							