

I. Project Title: **Annual Operation and Maintenance of the Fish Passage Structures at the Redlands Diversion Dam on the Gunnison River and the Government Highline Diversion Dam on the Upper Colorado River**

II. Principal Investigator(s): Chuck McAda, Project Leader
Bob D. Burdick, Fishery Biologist (LEAD)

Organization: Colorado River Fishery Project
Address: 764 Horizon Drive, Building B
Grand Junction, CO 81506-3946

Phone: (970) 245-9319
FAX: (970) 245-6933
E-mail: Chuck_McAda@FWS.GOV
Bob_Burdick@FWS.GOV

III. Project Summary:

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 both the fish passageways at the Redlands Diversion Dam on the Gunnison River and the Government Highline Diversion Dam on the Upper Colorado in Debeque Canyon.

Redlands. In 2005, the Redlands passageway was operational from 18 April to 10 October. This is the tenth year that the fish passageway at Redlands has been operated since it was completed in late-June 1996. In these 10 years, 71 sub-adult and adult Colorado pikeminnow, 15 razorback sucker, and one bonytail have ascended the fish passageway. Four sub-adult Colorado pikeminnow and six previously stocked razorback sucker used the fish passageway in 2005. Eleven thousand four hundred three fish were collected in the fish trap during 2005; 74% were native fish. Native fishes comprised about 92% of this total for each of the first 5 years. However, in 2002 and again in 2003, the percentage of native fish declined to about 66 and 68%, respectively. However, in 2004 and 2005, this trend was reversed. This marks the second year since 2000 that there has been an increase in the relative percentage of native fishes collected in the fish trap. Bluehead sucker comprised 48% of the total fish in the fish trap in 2005 followed by flannelmouth sucker (19%). White sucker were the most numerous nonnative fish collected (13% of the total) followed by channel catfish (6%). In 2005, the number of green sunfish (0.3%; 35 fish) declined for the second time in three years. However, the number of smallmouth bass has continued to increase since 2002; 21 were found in 2005. All nonnative fish, except salmonid species, were removed. Since its completion in 1996, 84,276 fish have used the fishway.

Government Highline. Government Highline Diversion Dam was operated on a trial basis for 6 days each in mid-June and late-September. In June, 2,527 fish were processed in the fish trap that included one razorback sucker and one humpback chub. In September, 2,111 fish were processed that included two humpback chub.

IV. Study Schedule:

Redlands Fish Passageway

- a. initial year: 1996
- b. final year: Ongoing

Government Highline Fish Passageway

- a. initial year: 2004
- b. final year: Ongoing

V. Relationship to RIPRAP:

A. Colorado River Action Plan: Gunnison River

- II.B.1.c. Operate and maintain fish ladder.
- II.B.1.d. Monitor and evaluate success.

B. 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.

VI. Accomplishment of FY 2005 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

A. FY-2005 Tasks and Deliverables:

Task 1. Routine O & M of the fish ladder and fish trap which includes monitoring, sorting, enumerating all fish in addition to cleaning trash and debris from trash racks, bar screens, fish trap, and fishway entrance.

Task completed at Redlands and Government Highline fish passageways.

Task 2. Compile, computerize, and summarize fish use data; prepare annual progress report.

Task completed at Redlands and Government Highline fish passageways.

B. Findings (2005 Highlights)

Fish Passage

Redlands Diversion Dam

1. Four sub-adult and adult Colorado pikeminnow were collected in the fish trap of the fish passageway at the Redlands Diversion Dam during 2005 (Appendix; Table 1). This brings the total number of Colorado pikeminnow that have been captured in the fish trap at the passageway of the Redlands Dam to 71 from 1996 through 2005 (Appendix; Table 2).

Two pikeminnow used the fishway in late-July and two other pikeminnow used the fishway in early-August, which is similar to the seasonal use patterns in former years, 1996-2004. The pikeminnow that was found in the fish trap on August 1 had previously been stocked at the Rifle Bridge (river mile 240.4) in the Upper Colorado River on 18 May 2004 by the Colorado Division of Wildlife. Between the stocking point and capture in the fish trap, this fish moved about 69 miles downstream in the Colorado River, negotiating three diversion dams, and finally moving into the Lower Gunnison River and traveling 2.3 miles upstream to the Redlands Diversion Dam (Appendix; Table 3).

2. Six razorback sucker were found in the fish trap during 2005. One razorback sucker used the fishway in late-July, four during August, and one in early-September. To date, 15 razorback sucker have been captured in the fish trap at the passageway of the Redlands Dam (Appendix; Table 2).
3. Eleven thousand four hundred three fish were trapped and counted in the trap of the Redlands Diversion Dam fishway between 18 April and 10 October 2005. Native fishes comprised 74% of the total number of fishes collected in 2005, compared to 94% in 1996 and 1997, 93% in 1998 and 1999, 92% in 2000, 83% in 2001, 66% in 2002, 68% in 2003, and 77% in 2004. From 2001–2003, there was a significant downward trend in the relative percentage of native fishes compared to the first 5 years that the ladder was operated and monitored when the relative percentage of native fishes was somewhat constant at about 92% per year (Appendix; Table 4).

Bluehead sucker comprised 48% of the catch and flannelmouth sucker 19% during 2005. The numbers of white sucker (1,520) that used the fish ladder in 2005 were the highest ever recorded during the 10 years of operation of the fish ladder at Redlands. Channel catfish numbers in 2005 (630) declined from 2004 (994). The number of green sunfish in 2005 (35) continued to decline compared to 61 in 2004, 330 in 2003 and 256 in 2002. However, the number of smallmouth bass in 2005 were the highest ever recorded in the fish trap (21) compared to 9 in 2004, 6 in 2003, and 13 in 2002 (Appendix; Figure 1).

4. All fish found in the fish trap were counted and sorted by species. All native fish including rainbow and brown trout were released upstream of Redlands Diversion Dam. All nonnative species plus hybrid suckers found in the trap were removed.

Government Highline Diversion Dam

1. The first trial test of the fish passageway was conducted in mid-June from the 16th to 24th. Colorado River flows as measured at the Cameo USGS gage 6.1 miles upstream ranged from about 7,650 cfs (June 16) to 13,600 cfs (June 23). Flow in the fish ladder was about 28 cfs; attraction flows were held constant at about 45 cfs throughout this first trial. A total of 2,527 fish were enumerated from the fish trap (Appendix; Table 5). The 6-day catch was comprised of six native fishes, three nonnative fishes, and three hybrid fishes. Native fish comprised 53% of the total fish trap catch; nonnative fish, 47%. For native fishes, flannelmouth sucker comprised the greatest number processed (797; 32% of the total) in the trap. For nonnative fish, 1,030 white sucker (41% of the total) were processed. One adult razorback sucker and one humpback chub were collected in the fish trap.
2. The second trial test of the fish passageway was conducted between 23 and 30 September. Colorado River flows measured at the Cameo USGS gage ranged from about 2,520 (September 27) to 4,250 cfs (September 29). Flows in the fish ladder were about 28-30 cfs; attraction flows were 18–20 cfs for the first three days but were increased to about 40 cfs until the ladder was closed (Appendix; Table 7). A total of 2,111 fish were processed from the fish trap (Table 6). The 6-day catch during September was comprised of 72% native fishes and 28% nonnative fishes. Two humpback chub were found in the fish trap. No other endangered fish were encountered. For native fish, roundtail chub comprised the greatest number processed (827; 39% of the total) in the fish trap. For nonnative fish, 321 white sucker (15% of the total) were the greatest number processed.
3. During both trial tests, fish catches in the fish trap were greatest initially and subsequently steadily tapered off over the remaining 5-day period (Tables 5 and 6).
4. All fish found in the fish trap were counted and sorted by species. All native fish including rainbow and brown trout were released upstream of the fish passage. All nonnative species plus hybrid suckers found in the trap were removed.

Operation and Maintenance

Redlands Diversion Dam

1. Maintenance to remove sediment delivered by the 2005 runoff flows in the Gunnison River and debris that accumulated over the past nine seasons in the fish entrance was performed during mid-June following runoff. A rubber-tired backhoe and 175 cfm diesel-powered air compressor furnished by the Bureau of Reclamation was used to accomplish this work. In mid-October, Redlands Water and Power Company lowered about 20 of their dam flash boards on the fish passageway side of the river for about 1 week. This created an artificial sluiceway which was intended to sluice sediment that had built up in front of the forebay of the fish passageway behind the dam. From initial observations, it appears that a considerable amount of sediment was removed in front of the fish passageway forebay.

Government Highline Dam

1. In late-October, about 100 cfs of river water was allowed to run through both the fish passage and attraction pipe for about 24 hours to remove sediment. The river bulkhead was used to isolate the river from the fish passage and the fish passage was pumped dry to evaluate sediment removal and to remove any fish trapped behind the diffuser grates. Unfortunately, a considerable amount of sediment still remained in the lower portion of the fish passageway. Following the pumping and removal of about 2,000 fish from the fish passageway, the bulkhead was lifted and river water was allowed to flood the lower end of the fish passageway.

VII. 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 2006 starting about 1 April and running through September or mid-October. At Government Highline Diversion Dam, initial plans for 2006 are to operate the fish passageway for about 10 days during pre-runoff river stage, about 10 days during runoff river stage, and about 10 days during post-runoff river stage. Information collected will include number of fish by species.

- B. Operation and Maintenance:

Redlands

1. To maintain optimum performance of the fish passageway, sediment maintenance should be performed more regularly than in the past to prevent buildup and compaction of sediment in front of the fish passage. This should be performed 2-3 times per year—once following runoff and intermittently as needed through the

summer months. Use of compressed air has proven to be a useful tool in alleviating build-up of sediment and small debris. With the cooperation and coordination of Redlands Water and Power Company, sluice the sediment in the pond behind the dam by dropping about 15-20 of the dam flash boards on the fish passage side of the river in the spring and fall when Redlands is conducting canal maintenance and repair.

Government Highline

1. In the spring prior to operation of the fish passageway, sediment from the fish passageway should be sluiced. This could be accomplished by alternating flows between the fish ladder and attraction flow chamber for 2 to 3 days each to optimize sediment removal. Coordination with Grand Valley Water Users' Association officials will be required for this and other fish passage operations.
2. During each of the scheduled 10-day periods when the fish passage is operated, attempt different attraction flows to determine which attraction flows at different river stages optimize fish catches in the trap.

VIII. Project Status:

A. "On track and ongoing".

IX. FY 2005 Budget Status

- A. Funds Provided: \$ 32,900
- B. Funds Expended: \$ 32,900
- C. Difference: \$ -0-
- D. Percent of the FY 2005 work completed, and projected costs to complete: 100%.
Recovery Program funds spent for publication charges: \$ -0-

X. Status of Data Submission (Where applicable): The four Colorado pikeminnow and six razorback sucker captured in the fish trap of the passageway at the Redlands Diversion Dam during 2005 were checked for a PIT-tag. Only one Colorado pikeminnow and all six razorback sucker had been previously PIT-tagged. Three Colorado pikeminnow were PIT tagged prior to their release. One razorback sucker and one humpback chub captured at the Government Highline fish trap were PIT tagged. The following data were collected from all T & E fish prior to their being released: total length (mm), weight (g), reproductive condition, and date and location of capture. These data have been computerized. The total number of fishes that were collected in the fish traps at both Redlands and Government Highline fish passageways were also computerized. These completed, computerized data will be provided to the UCRB database coordinator upon his request.

XI. Signed: Bob D. Burdick 11/14/2005
Principal Investigator Date

APPENDIX:

- A. More comprehensive/final project reports. If distributed previously, simply reference the document or report.

Burdick, B. D. 2001. Five-year evaluation of fish passage at the Redlands Diversion Dam on the Gunnison River near Grand Junction, Colorado: 1996-2000. Recovery Program Project Number CAP-4b. Final Report prepared for the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin. U. S. Fish and Wildlife Service, Colorado River Fishery Project, Grand Junction, Colorado. 57 pp. + appendices.

- B. Appendix: 7 tables and 1 figure attached.

Prepared and compiled by Bob D. Burdick, 11/14/2005; 2005-redlands-0&M-rpt.wpd

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 10 October 2005.

<u>Common Name</u>	<u>Number of Fish</u>	<u>Percent of Total Fish</u>
NATIVE FISH		
bluehead sucker	5,461	47.9
flannelmouth sucker	2,195	19.2
razorback sucker	6	< 0.1
roundtail chub	741	6.5
Colorado pikeminnow	4	< 0.1
bonytail	0	0
speckled dace	3	< 0.1
TOTAL	8,410	73.8
NONNATIVE FISH		
black bullhead	83	0.7
brown trout	18	0.2
channel catfish	630	5.5
common carp	154	1.4
bluegill	5	< 0.1
green sunfish	35	0.3
smallmouth bass	21	0.2
rainbow trout	4	< 0.1
white sucker	1,520	13.3
TOTAL	2,449	21.5
HYBRID FISHES		
bluehead sucker X flannelmouth sucker	4	< 0.1
bluehead sucker X white sucker	381	3.3
flannelmouth sucker X white sucker	137	1.2
TOTAL	522	4.5

ALL TOTALS	11,403	100.0

APPENDIX (cont.)

Table 2. Number of Colorado pikeminnow, razorback sucker, and bonytail captured in the fish trap of the Redlands passageway between 1996 and 2005.

<u>Year</u>	<u>No. of Colorado pikeminnow</u>	<u>No. of Razorback sucker^a</u>	<u>No. of Bonytail^a</u>
1996	1	0	0
1997	18	0	0
1998	23	0	0
1999	5	0	0
2000	4	0	0
2001	1	5	0
2002	7	1	0
2003	3	0	1
2004	5	3	0
2005	4	6	0
Totals	71	15	1

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

Table 3. Capture statistics for four sub-adult and adult Colorado pikeminnow (CS) and six razorback sucker (RZ) captured in the fish trap of the Redlands passageway, 18 April through 10 October 2005.

<u>Total Name</u>	<u>Most Recent Capture Data</u>			<u>Wild or Stocked</u>	<u>Fish</u>	<u>Former Capture or Stocking Data</u>					
	<u>Weight Length (mm)</u>	<u>Recapture (g)</u>	<u>Date</u>			<u>Y</u>	<u>N</u>	<u>River Date</u>	<u>River</u>	<u>Total Mile</u>	<u>Time at Length (mm)</u>
CS	422		7/24		X	Wild	--	--	--	--	--
CS	602		7/24		X	Wild	--	--	--	--	--
CS	302		8/01	X		Stocked	5/18/04	CO	240.4	205	1.19
CS	501		8/05		X	Wild	--	--	--	--	--
RZ	497		7/24	X		Stocked	6/21/01	GU	57.1	480	4.09
RZ	395		8/01	X		Stocked	11/02/02	GU	57.1	330	2.74
RZ	445		8/16	X		Stocked	11/03/01	GU	57.1	248	3.78
RZ	461		8/23	X		Stocked	10/30/01	GU	57.1	286	3.74
RZ	395		8/29	X		Stocked	11/13/02	GU	57.1	305	2.79
RZ	474		9/08	X		Stocked	04/03/01	GU	57.1	--	4.43

APPENDIX (cont'd)

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 2005.

<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
Totals	84,276	70,814	13,462	84.0	16.0

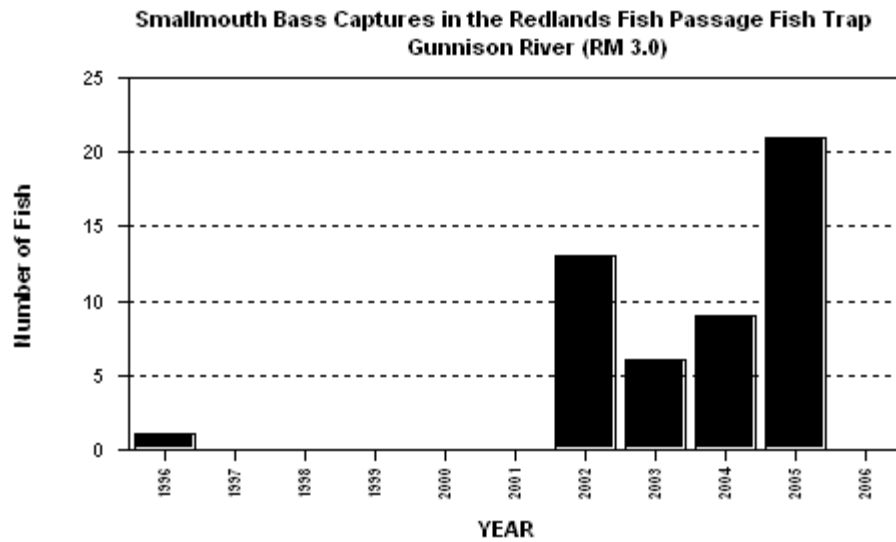


Figure 1. Number of smallmouth bass collected in the fish trap of the Redlands fish passageway, 1996–2005.

APPENDIX (cont'd)

Table 5. Total number of juvenile and adult fish captured in the fish trap of the passageway at the Government Highline Diversion Dam, 16 June and 20 to 24 June 2005.

Common Name	No. of Fish						Total
	Day 1 ^a	Day 2	Day 3	Day 4	Day 5	Day 6	
NATIVE FISH							
bluehead sucker	86	11	26	19	19	5	166
flannelmouth sucker	520	11	120	53	63	30	797
razorback sucker	0	1	0	0	0	0	1
roundtail chub	22	130	38	72	83	29	374
mountain whitefish	0	0	1	1	0	0	2
humpback chub	0	0	0	0	1	0	1
TOTAL	628	153	185	145	166	64	1,341
NONNATIVE FISH							
common carp	0	0	1	1	0	1	3
rainbow trout	1	0	0	0	0	0	1
white sucker	126	210	272	168	122	132	1,030
TOTAL	127	210	273	169	122	133	1,034
HYBRID FISHES							
bluehead sucker X flannelmouth sucker	0	0	0	0	1	1	2
bluehead sucker X white sucker	32	5	1	5	8	5	56
flannelmouth sucker X white sucker	40	14	17	7	12	4	94
TOTAL	72	19	18	12	21	10	152

ALL TOTALS	827	382	476	326	309	207	2,527

% Native fish: $1,343/2,527=53\%$

% Nonnative fish: $1,184/2,527=47\%$

^a Fish in the fish trap were enumerated only after the fish ladder had been run for about 5 hours.

APPENDIX (cont'd)

Table 6. Total number of juvenile and adult fish captured in the fish trap of the passageway at the Government Highline Diversion Dam, 23 September, and 26 to 30 September 2005.

Common Name	No. of Fish						Total
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	
NATIVE FISH							
bluehead sucker	54	174	38	2	9	23	394
flannelmouth sucker	189	75	16	7	40	67	300
roundtail chub	427	82	192	15	32	79	827
mountain whitefish		0	1	0	0	0	01
humpback chub	1	1	0	0	0	0	2
TOTAL	671	333	246	24	81	169	1,524
NONNATIVE FISH							
white sucker	143	120	19	7	11	21	321
largemouth bass	0	1	0	0	0	0	1
brown trout	1	2	0	0	1	0	4
smallmouth bass	0	2	1	0	0	1	4
TOTAL	144	125	20	7	12	22	330
HYBRID FISHES							
bluehead sucker X white sucker	47	18	1	0	3	3	72
flannelmouth sucker X white sucker	117	37	6	1	15	9	185
TOTAL	164	55	7	1	18	12	257

ALL TOTALS	979	513	273	32	111	203	2,111

% Native fish: $1,524/2,111=72\%$

% Nonnative fish: $587/2,111=28\%$

APPENDIX (cont'd)

Table 7. Total number of fish processed in the fish trap per day vs. hydrology characteristics of the fish ladder at Government Highline Diversion Dam and flows in the Upper Colorado River, 22 September to 30 September 2005.

<u>Date</u>	<u>Day</u>	Total No. of Fish	Ladder Flow (cfs)		River Flows (cfs) ^a	
		<u>In the Fish Trap</u>	<u>Attraction</u>	<u>Fish Ladder</u>	<u>Min</u>	<u>Max</u>
22 nd	0	- -	18-20	28-30	2,640	2,840
23 rd	1	979	18-20	28-30	2,660	2,860
24 th	-	Not Run	~ 40	28-30	2,640	2,780
25 th	-	Not Run	~ 40	28-30	2,580	2,680
26 th	2	513	~ 40	28-30	2,540	2,640
27 th	3	273	~ 40	28-30	2,520	3,070
28 th	4	32	~ 40	28-30	2,820	3,470
29 th	5	111	~ 40	28-30	3,540	4,250
30 th	6	203	~ 40	28-30	3,380	3,540

^a as measured at the USGS Cameo gaging station, 6.1 miles upstream from the Government Highline Diversion Dam.