

I. Project Title: Young-of-the-year Colorado pikeminnow monitoring

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III. Project Summary:

Monitoring of young-of-year (YOY) Colorado pikeminnow (*Ptychocheilus lucius*) was initiated in 1986 within the upper Colorado River basin as part of the Interagency Standardized Monitoring Protocol (ISMP). The ISMP sampling was proposed to monitor recruitment success of first year endangered fishes, to correlate cohort strength and condition to abiotic and biotic parameters, and to provide data for a predictive model measuring future cohort strength. Since its inception, the ISMP protocol for YOY pikeminnow has been updated to refine its scope and methods to focus not only on pikeminnow but all small-bodied fishes allowing for assessment of other projects such as nonnative control actions.

As a result of decreased pikeminnow recruitment, control actions targeting nonnative gamefish species, primarily smallmouth bass (*Micropterus dolomieu*) and northern pike (*Esox lucius*), are being evaluated across the upper Colorado River Basin to determine the level of reduction necessary to minimize the threat. Successful implementation of nonnative fish removal is in part measured by the response of endangered fish and other native species (i.e., increased abundance). It is hypothesized that the initial positive response to control efforts will be evident in early life-stages of the native fish community.

The Utah Division of Wildlife (UDWR) has been responsible for monitoring YOY Colorado pikeminnow abundance since 1986. In 2004, this project was expanded to explore linkages between trends in YOY abundance (collected in this study), with abundances of larval (current Project No. 22f) and juvenile pikeminnow (old ISMP data set; and current Project No. 128). Those analyses were not completed. In late 2008, in conjunction with uncertainties identified in the *Green River Study Plan*, the Recovery Program decided to conduct a separate comprehensive synthesis of the effect of changes in physical habitat (as a function of flow and flow variability) and other environmental conditions on the small bodied fish community (emphasis on Colorado pikeminnow). That comprehensive synthesis was initiated in 2009, entitled *Historical assessment of factors affecting young Colorado pikeminnow abundance and physical habitat availability in the Green River, Utah*. The UDWR's analysis under this Project 138 will once again focus on long term trends in YOY pikeminnow and small bodied fishes.

- IV. Study Schedule: It is anticipated that this study will continue indefinitely and will be a component of studies designed to evaluate a variety of management actions.
- V. Relationship to RIPRAP: Reproduction and recruitment of early life stages are critical components of the life history of endangered Colorado pikeminnow. Understanding trends in reproductive success may help define status of Colorado pikeminnow in specific river reaches in the Colorado River Basin and should play a role in determining when recovery has been achieved.

Relationship to specific RIPRAP items:

Green River Action Plan: Mainstem

- V. Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management).
 - V.A. Measure and document population and habitat parameters to determine status and biological response to recovery actions.
- VI. Accomplishment of FY 2010 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings

Project Objectives:

1. Determine size and relative abundance of YOY Colorado pikeminnow at the end of their first growing season to complement larval and juvenile sampling data.
2. Estimate the response of small-bodied and YOY native fish to removal of northern pike and smallmouth bass.
3. Determine relationships between YOY Colorado pikeminnow CPUE abundance estimates with respect to flow and temperature.

Task Description (FY 2010):

1. Middle Green River (reach 4) Seine backwaters and low velocity habitats to collect data for endangered, native, and nonnative fish. Collect physical habitat data.
2. Lower Green River (reach 3) Seine backwaters and low velocity habitats to collect data for endangered, native, and nonnative fish. Collect physical habitat data.
3. Lower Colorado River (reach 1) Seine backwaters and low velocity habitats to collect data for endangered, native, and nonnative fish. Collect physical habitat data.
4. Data entry.
5. Data analysis and report preparation.

Accomplishments by task (FY 2010).

Task 1: Middle Green River: Reach 4

Annual monitoring for YOY Colorado pikeminnow began on 20 September and was completed on 29 September 2010. Seining began at the uppermost sub-reach near river-mile (RM) 319 (Split Mountain boat ramp) and continued down-river by sampling three backwater habitats within every 5-mile sub-reach, concluding at RM 215 (Sand Wash). Not all 5-mile sub-reaches contained three backwaters and a total of 56 backwaters were sampled. Main channel temperatures ranged from 12.8°C to 21.6°C. Backwater temperatures ranged from 13.1°C to 29.6°C. Green River discharge (measured at the USGS gauge #09261000 near Jensen) ranged from 2,089 cfs to 2,200 cfs during the sampling period. These flows are above the mean daily values (1,900 – 2,000 cfs) for this time of year based on the period of record for this gauge (1947 – 2010). Conditions in 2010 were slightly different than during the 2009 sampling effort. Sampling in 2009 began on 22 September and ended on 1 October. During 2009 sampling, discharge ranged from 2,470 – 2,570 cfs and temperatures ranged from 11.2°C to 19°C in the main channel and 11.5°C to 21.5°C in backwaters.

From the first two backwaters in each five-mile sub-reach, 458 YOY Colorado pikeminnow were captured, measured, and released (Table 1). An additional 39 YOY pikeminnow were captured in the third backwater of each sub-reach. Young-of-year pikeminnow collected from primary and secondary backwaters averaged 38.1 mm total length (TL) (does not include four YOY pikeminnow that were not measured), while YOY pikeminnow averaged 42.5 mm in tertiary backwaters. One juvenile Colorado pikeminnow was captured in a secondary backwater (TL = 129 mm).

Additional YOY native species collected from primary and secondary backwaters included four flannelmouth sucker, 38 bluehead sucker, and one speckled dace (Table 2). Additional YOY native species collected in tertiary backwaters included two bluehead sucker and one adult razorback sucker (348 mm). Seine samples continue to be dominated by small-bodied nonnative cyprinids including fathead minnow, red shiner, and sand shiner (Table 3). However, total abundance of red and sand shiners has decreased substantially from high abundance years such as 2006 (Table 3). We collected a total of 11 nonnative species in seine samples compared to nine in 2005, 12 in 2006, 13 in 2007, 14 in 2008 and 12 in 2009 (Table 3). Nonnative species collected (primary backwaters and first seine hauls only) included fathead minnow ($n = 231$), common carp ($n = 38$), green sunfish ($n = 15$), red shiner ($n = 3566$), sand shiner ($n = 959$), white sucker ($n = 8$), black bullhead ($n = 1$), and channel catfish ($n = 1$) (Table 3). Nonnative species collected from the tertiary backwaters (first seine hauls only) included fathead minnow ($n = 101$), red shiner ($n = 1365$), sand shiner ($n = 399$), green sunfish ($n = 49$), common carp ($n = 17$), white sucker ($n = 1$), channel catfish ($n = 2$), and gizzard shad ($n = 3$).

Task 2: *Lower Green River (Reach 3)*

Annual monitoring for YOY Colorado pikeminnow in Reach 3 began on September 12 and was completed on September 14, 2010. Seining was conducted on the Green River from RM 120 (Green River State Park) to RM 0 (confluence with the Colorado River). Samples were collected at two backwater habitats within every 5-mile sub-reach, as available. A total of 29 of 48 possible backwaters were sampled in 20 of 24 sub-reaches in the lower Green River. Reach 3 water temperatures ranged from 19 to 22 °C in the main channel and 16 to 28 °C in backwaters. Lower Green River flows (measured at USGS Gage #9315000 in Green River) fell from 2300 cfs to 2280 cfs over the three days of sampling.

The lower Green River, measured at USGS Gage #9315000 in Green River, peaked this year on June 10 at 23,900 cfs (Figure 1). This is slightly higher and later than the 46-year (since Flaming Gorge Dam operation began in 1964) median peak of 17,400 cfs on May 28, but consistent with long-term trends. Basin-wide flash flooding in August caused significant changes to the fluvial geology of side canyons, outwashes, backwaters, sandbars, and the main channel of the Green River. At the time of sampling, some backwaters had been scoured out and were still flowing; some areas had been flushed out and dropped suddenly leaving isolated pools where backwaters once were; other

backwater habitats were clogged with sediment and debris from nearby flash floods. These events and resulting changes to backwater habitats may be correlated to lower numbers and shorter lengths of Colorado pikeminnow found during sampling as fish may have been washed out of habitats they had moved into before flooding. Because the locations of these stochastic climatic events were downstream from the Green River gage, we cannot track them using the current flow data.

In the lower Green River, 131 YOY Colorado pikeminnow were captured and measured. All fish were sorted, identified and enumerated in the field. The number of YOY Colorado pikeminnow captured was less than in 2009 (423 fish). This is also lower than the 10-year average (193.70 fish/year), 15-year average (248.47 fish/year), and 25-year average (501.08 fish/year) (Table 4). The CPUE this year was 4.57 fish/100m², lower than the 10-year and 15-year averages (6.27 fish/100m² and 7.22 fish/100m², respectively), and considerably lower than the 25-year average of 14.88 fish/100m² (Table 4). The average length of YOY Colorado pikeminnow was 29.86 mm, shorter than the 10, 15, and 25-year averages (43.36 mm, 39.46 mm, and 39.24 mm, respectively) (Table 4).

Other native species captured in the lower Green River were 3 juvenile Colorado pikeminnow, 7 flannelmouth suckers, 3 bluehead suckers, and 12 speckled dace (Table 5).

Nonnative captures were enumerated during the first seine haul in each primary habitat. Total catches in reach 3 was once again dominated by nonnative cyprinids. Five nonnative species were present compared to six in 2009 (Table 6). These included red shiners (n = 1028), sand shiners (n = 1025), fathead minnows (n = 150), green sunfish (n=5), and gizzard shad (n = 4). Fifty green sunfish were found in a secondary backwater. While these cannot be included in the data set because they were not found in a primary backwater, it is worth noting that the average number of green sunfish found between 1986 and 2009 is 2.42 fish/year.

Task 3: *Colorado River (Reach 1)*

Annual monitoring for YOY Colorado pikeminnow in Reach 1 began on September 13 and was completed on September 17, 2010. Seining on the Colorado River was conducted from RM 110 (Cisco Landing) to RM 0 (confluence with the Green River). Backwater habitats were sampled within every 5-mile sub-reach, as available. A total of 38 of 44 possible backwaters were sampled in 21 of 22 sub-reaches in the Colorado River. Reach 1 water temperatures ranged from 17 to 22 °C in the main channel and 13 to 31 °C in backwaters. Colorado River flows (measured at USGS Gage #9180500 near Cisco) started at 3660 cfs and fell to 3280 cfs over the five days of sampling.

The lower Colorado River, as measured at USGS Gage #9180500 near Cisco, peaked this year on June 19 at 30,300 cfs (Figure 2). This is higher and later than the 50-year median peak of 17,900 cfs on May 30, but consistent with long-term trends. The lower Colorado

River did not see the magnitude of impacts from flooding events that the lower Green River saw. There were, however, several spikes in flow that appeared on the hydrograph in August. Once again, because the gage is above the reach it is not possible to track events that may be localized within the reach.

In the lower Colorado River, 27 YOY Colorado pikeminnow were captured and measured. All fish were sorted, identified and enumerated in the field. The number of Colorado pikeminnow captured is lower than in 2008 when 243 YOY Colorado pikeminnow were captured (Table 7). It is also lower than the 10-year average (37.5 fish/year), the 15-year average (116.8 fish/year), and the 25-year average (133.48 fish/year) (Table 7). The CPUE this year was 1.03 fish/100m², which is lower than the 10-year average CPUE (1.49 fish/100m²), the 15-year average CPUE (2.99 fish/100m²), and the 25-year average CPUE (4.30 fish/100m²) (Table 7). The average length of YOY Colorado pikeminnow was 35.93 mm, which is slightly lower than the 10-year average (41.31 mm), the 15-year average (37.97 mm), and the 25-year average (38.24 mm) (Table 7).

Other native species captured in the Colorado River included 3 juvenile Colorado Pikeminnow, 2 *Gila* spp., and 15 flannelmouth suckers (Table 8).

Eight nonnative species were captured in the Reach 1 (Table 9). Nonnative captures were again only enumerated during the first seine haul in each primary habitat in the lower Colorado River. Nonnative fish captured included red shiners (n = 657), sand shiners (n = 622), fathead minnows (n = 377), gizzard shad (n = 174), largemouth bass (n = 5), gambusia (n = 3), channel catfish (n = 2), and walleye (n = 1). Gizzard shad first appeared in seine hauls in 2007 (n = 15) and have increased in numbers every year since (Table 9).

Task 4: Data entry was completed by October 1 for all reaches and database and management is ongoing.

Task 5: Data analysis and report writing is on track and the annual report will be provided by November 15, 2010.

VII. Recommendations:

- a. Continue to monitor annual relative abundance of post-larval Colorado pikeminnow in the middle Green River, lower Green River and lower Colorado River to develop indices and determine the relationships between these indices and stream flow, water temperature, abundance of sympatric fishes, and physical characteristics of backwaters.
- b. Protocols for species identification of captured YOY *Gila* spp. need to be developed in order to detect successful reproduction by hatchery-reared stocked bonytail. This

may include preserving a sub-sample of captured YOY *Gila* spp. for laboratory identification.

- c. Temperature trends on the lower Green River and lower Colorado River cannot be examined because continuous and accurate temperature data is not available from current local gages. Determine if temperature is as directly correlated to YOY survival as flow or major climatic events. If it is concluded that temperature is an important factor to consider, deploy Hobo temperature loggers to get more accurate data.
- d. Develop a measure or scale to describe localized hydrologic/climatic events. Although the magnitude and timing of peak flows have been found to be related to YOY abundance and growth, we do not have an adequate measure for more localized hydrologic/climatic events, exemplified by a single large storm over Island in the Sky this year which completely removed Mineral Bottom road and flushed large amounts of sediment down washes which make up a significant percentage of the zero velocity habitat in the lower Green. Although this was one of the biggest flash flood events ever observed in Canyonlands, the nearest USGS gauge is 50 miles upstream and showed no change during this event.

VIII. Project Status:

On track and ongoing

IX. FY 2010 Budget Status

- A. Funds Provided: \$49,202
- B. Funds Expended: \$49,202
- C. Difference: \$0
- D. Percent of the FY 2010 work completed: 100%
- E. Recovery Program funds spent for publication charges: \$0

X. Status of Data Submission: Data is formatted and has been QA/QC checked and will be submitted to the USFWS by January 2011.

XI. Signed: Katie Creighton, Leisa Monroe November 10, 2010
Investigator Date

Table 1. The middle Green River (Reach 4) total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by year for YOY Colorado pikeminnow caught during young-of-year monitoring for the period of 1990—2010. *To be consistent with previous years, information in this table contains only those individuals captured in the first two backwaters of a subreach.*

* Four YOY Colorado pikeminnow were not included because they were not measured.

Year	Colorado Pikeminnow Caught	Mean Length (mm)	Length Range (mm)	Total Area Sampled (m²)	CPUE (Fish/100m²)
1990	341	45.4	28 – 80	5093	5.5
1991	524	38.2	21 – 65	5077	10.3
1992	183	43.1	26 – 133	4697	3.9
1993	305	36.4	21 – 59	3960	7.7
1994	15	67.2	60 – 80	4356	0.3
1995	75	34.5	21 – 48	3792	2.0
1996	79	39.4	25 – 60	3912	2.0
1997	22	36.0	28 – 49	3734	0.6
1998	73	38.5	22 – 61	4986	0.9
1999	12	33.7	25 – 45	3897	0.3
2000	31	50.9	37 – 76	3798	0.8
2001	8	46.9	36 – 67	4496	0.2
2002	0	N/A	N/A	5202	0
2003	2	52	52 – 52	4696	0.04
2004	60	43.8	31 – 63	4686	1.28
2005	8	48.6	35 – 60	4190	0.2
2006	5	45.8	36 – 50	7490	0.07
2007	3	73.3	69 – 76	5782	0.05
2008	18	43.9	36 – 56	4994	0.36
2009	325	43.7	22 – 71	7503	4.3
*2010	454	38.1	24 – 58	--	--

Table 2. The middle Green River (Reach 4), total captures by year for native and endangered fish during young-of-year monitoring on 1986-2010. Colorado pikeminnow abundance reflects captures from primary and secondary backwaters sampled in each subreach; abundance of other native species reflects captures from primary backwaters only. In some years, species other than Colorado pikeminnow were only enumerated during the first seine haul within primary backwaters. Species collected include YOY Colorado pikeminnow (CS YOY; 10 – 99 mm), juvenile pikeminnow (CS JUV; 100 – 99 mm), unidentified *Gila* spp. (CH), bonytail (BT), roundtail chub (RB), flannelmouth sucker (FM), bluehead sucker (BH), and speckled dace (SD).

Year	CS YOY	CS JUV	CH	BT	RT	FM	BH	SD
1986	492	0	32	–	0	47*	47*	132
1987	209	10	19	–	0	67	277	2
1988	885	36	5	–	0	120	1	6
1989	62	0	41	–	0	16	80	3
1990	341	47	22	–	0	0	9	2
1991	524	0	7	–	0	0	0	0
1992	183	0	4	–	1	2	115	11
1993	305	0	40	–	0	54	80	7
1994	15	0	13	–	0	38	32	10
1995	75	0	6	–	0	20	62	33
1996	79	0	6	–	1	31	53	7
1997	22	0	42	–	0	12	73	8
1998**	73	0	63	–	0	25	49	6
1999	12	0	43	–	0	18	20	16
2000**	31	0	3	–	0	6	12	2
2001	8	0	23	–	0	78	0	0
2002	0	0	3	–	0	3	0	0
2003	2	0	2	–	0	4	2	0
2004	60	0	12	–	0	16	2	1
2005	8	2	13	–	0	7	3	2
2006	5	0	0	–	0	5	0	0
2007	3	1	2	–	0	10	11	0
2008	18	0	0	–	1	12	6	0
2009	325	0	0	–	13	57	36	1
2010	458	1	0	–	0	2	0	1

*Suckers not identified to species, thus half of suckers were applied to bluehead and half to flannelmouth.

**One razorback sucker YOY was observed as well.

Table 3. Total abundance of nonnative fish collected during young-of-year monitoring in the middle Green River (Reach 4) from 1987 -2009. Only fish enumerated in primary backwater first seine hauls are included. Species collected include black bullhead (BB), black crappie (BC), bluegill (BG), channel catfish (CC), common carp (CP), fathead minnow (FH), gambusia (GA), green sunfish (GS), gizzard shad (GZ), largemouth bass (LG), northern pike (NP), plains killifish (PK), red shiner (RS), smallmouth bass (SM), sand shiner (SS), walleye (WE), white sucker (WS), and yellow bullhead (YB).

YEAR	BB	BC	BG	CC	CP	FH	GA	GS	GZ	LG	NP	PK	RS	SM	SS	WE	WS	YB
1987	0	0	0	1	3	873	0	8	0	0	0	0	9757	0	462	0	0	0
1988	2	0	0	7	2	620	0	13	0	0	0	0	4072	0	159	0	0	0
1989	0	0	0	7	43	865	0	22	0	0	0	0	4025	0	284	0	0	0
1990	0	0	0	1	4	1386	0	0	0	0	0	0	5395	0	87	0	0	0
1991	0	0	0	14	5	1	0	1	0	0	0	0	64	0	0	0	0	0
1992	1	0	0	3	15	1653	0	5	0	0	0	0	3178	0	440	0	0	0
1993	0	0	0	17	13	1512	0	3	0	0	0	0	4677	0	49	0	0	0
1994	0	1	0	0	0	2757	0	1	0	0	0	0	28,903	0	1890	0	0	0
1995	0	0	0	0	6	1304	0	1	0	0	0	0	3229	1	188	0	0	0
1996	0	0	0	0	5	486	0	8	0	0	0	0	2871	0	1265	0	0	0
1997	0	4	0	0	11	1067	0	3	0	0	0	0	1010	1	1152	0	3	0
1998	7	11	0	3	8	1569	0	17	0	0	1	0	2400	0	474	0	1	0
1999	3	3	0	0	23	407	0	68	0	0	0	0	1832	0	533	0	0	0
2000	2	3	0	0	12	1436	0	15	0	0	0	0	10,860	0	8072	0	0	0
2001	1	10	0	6	0	371	0	0	0	0	0	0	4512	0	283	0	0	0
2002	0	5	1	0	1	1303	0	39	0	0	0	0	11,516	0	1059	0	1	0
2003	0	1	0	0	48	89	0	0	0	0	0	0	3847	0	49	0	0	0
2004	0	1	0	4	1	337	0	8	0	0	0	0	5524	0	1207	0	5	0
2005	0	18	0	1	1	204	0	0	0	0	0	0	3654	0	552	0	0	0
2006	0	7	3	0	98	1431	0	1	5	0	0	0	19,365	0	2060	0	3	0
2007	9	0	0	10	16	327	0	0	3	0	0	0	5754	6	3940	0	13	0
2008	1	16	0	3	40	155	0	102	0	0	0	0	1121	5	821	0	7	0
2009	0	4	0	0	17	108	0	1	2	0	0	0	2101	1	417	0	5	0
2010	1	0	0	1	38	231	0	15	0	0	0	0	3566	0	959	0	8	0

Table 4. The lower Green River (Reach 3) total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by year for YOY Colorado pikeminnow caught during young-of-year monitoring for the period of 1986—2010.

Reach 3	YOY Colorado	Mean Length	Length Range	Total Area	CPUE
Year	Caught	(mm)	(mm)	(m²)	(fish/100m²)
1986	813	28.63		1964	41.40
1987	849	36.32		2831.8	29.98
1988	2892	39.41		3076.4	94.01
1989	1494	38.79		4261.8	35.06
1990	418	41.82		6516.6	6.41
1991	186	38.81		2822.2	6.59
1992	122	40.62		5181.6	2.35
1993	1616	37.36		4435.4	36.43
1994	354	37.36	14-74	3797.8	9.32
1995	56	49.98	23-99	2548	2.20
1996	410	24.94	13-45	2888.6	14.19
1997	39	41.4	19-75	2709.8	1.44
1998	252	33.1	19-40	3050.2	8.26
1999	384	32.1	18-68	4055.8	9.47
2000	705	26.8	15-38	5760	12.24
2001	17	37.9	21-88	5962	0.29
2002	22	43.2	30-68	4644.5	0.47
2003	124	64.9	22-90	4005.8	3.10
2004	80	60.1	30-96	1974	4.05
2005	63	46	26-84	2937.6	2.14
2006	331	31.2	23-41	4936	6.71
2007	686	40.3	23-80	3138	21.86
2008	60	44.8	26-95	2018	2.97
2009	423	35.32	20-46	2548	16.60
2010	131	29.86	15-45	2868	4.57

Table 5. The lower Green River (Reach 3), total captures by year for native and endangered fish during young-of-year monitoring on 1986-2010. Species listed are: YOY Colorado pikeminnow (CS YOY; 10-99mm), juvenile pikeminnow (CS JUV; 100-399 mm), unidentified *Gila* spp.(CH), Bonytail (BT), humpback chub (HB), flannelmouth sucker (FM), bluehead sucker (BH), and speckled dace (SD). In most years species other than CS were only enumerated during the first haul within primary backwaters.

Year	CS YOY	CS JUV	CH	BT	HB	FM	BH	SD
1986	813	0	15	0	0	0	0	24
1987	849	9	1	0	0	5	1	0
1988	2892	109	0	0	0	2	0	2
1989	1494	59	1	0	0	17	0	0
1990	418	21	0	0	0	0	0	7
1991	186	3	0	0	0	0	2	2
1992	122	12	18	0	0	3	7	4
1993	1616	2	0	0	0	12	33	43
1994	354	0	7	0	1	0	1	6
1995	56	1	5	0	0	12	17	35
1996	410	1	0	0	0	1	21	20
1997	39	8	2	0	0	0	2	2
1998	252	0	0	0	0	0	3	30
1999	384	0	2	0	0	90	5	24
2000	705	3	1	0	0	0	0	5
2001	17	0	0	0	0	0	0	3
2002	22	0	1	0	0	4	0	4
2003	124	0	5	0	0	0	0	2
2004	80	0	0	0	0	1	1	0
2005	63	1	0	0	0	0	0	0
2006	331	0	6	0	0	0	0	0
2007	686	0	1	2	0	0	0	0
2008	60	1	0	0	0	8	0	1
2009	423	0	1	0	0	0	0	2
2010	131	3	0	0	0	7	3	12

Table 6. The lower Green River (Reach 3), total captures by year for nonnative fish during young-of-year monitoring on 1986-2009. Only fish enumerated in the first haul within each primary backwater are counted in these totals to provide consistency among years and reaches. Species listed are: black bullhead (BB), black crappie (BC), bluegill (BG), channel catfish (CC), common carp (CP), fathead minnow (FH), gambusia (GA), green sunfish (GS), gizzard shad (GZ), largemouth bass (LG), northern pike (NP), plains killifish (PK), red shiner (RS), smallmouth bass (SM), sand shiner (SS), walleye (WE), white sucker (WS), and yellow bullhead (YB).

YEAR	BB	BC	BG	CC	CP	FH	GA	GS	GZ	LG	NP	PK	RS	SM	SS	WE	WS	YB
1986	7	0	0	4	12	87	0	9	0	0	0	0	663	0	4	0	0	0
1987	0	0	0	1	0	34	0	5	0	0	0	0	1,303	0	4	0	0	0
1988	1	0	0	110	2	1,790	7	1	0	0	0	0	4,317	0	38	0	0	0
1989	1	0	0	73	1	170	0	3	0	0	0	0	5,826	0	113	0	0	0
1990	1	0	0	37	4	228	0	0	0	0	0	0	9,599	0	129	0	0	0
1991	0	0	0	8	3	314	0	2	0	0	0	0	7,746	0	1,123	0	0	0
1992	1	0	0	24	1	500	0	0	0	0	0	0	2,737	0	180	0	0	0
1993	1	0	0	11	1	249	0	0	0	0	0	0	3,443	0	1,362	0	0	0
1994	0	0	0	6	8	500	1	8	0	0	0	0	8,007	0	1,196	0	0	0
1995	7	0	0	4	16	363	0	6	0	0	0	0	3,478	0	969	0	0	0
1996	0	0	0	0	0	1,097	2	2	0	0	0	0	11,858	0	3,751	0	0	0
1997	0	0	0	17	1	79	4	3	0	0	0	0	855	0	320	0	1	0
1998	0	6	0	0	1	120	17	0	0	0	0	0	1,709	0	178	0	0	0
1999	0	1	0	2	37	340	1	0	0	0	0	0	845	0	156	0	0	0
2000	3	0	0	12	3	234	0	1	0	0	0	0	3,591	0	574	0	4	0
2001	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	122	2	14,721	0	1	0	0	0	0	26,710	0	2,135	0	0	0
2003	5	0	0	11	1	201	0	12	0	0	0	0	4,707	0	43	0	0	0
2004	3	0	0	7	0	215	0	1	0	0	0	0	297	0	190	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	2	1	0	6	3	1,187	1	4	0	1	0	0	8,623	0	0	0	0	0
2007	0	0	0	23	0	2,183	0	0	1	2	0	0	8,807	0	35	0	0	0
2008	0	2	0	13	116	1,074	0	0	1	1	0	0	4,458	0	250	0	0	6
2009	0	0	0	3	0	1,044	0	0	1	0	0	0	2,766	0	15	0	0	0
2010	0	0	0	0	0	150	0	5	4	0	0	0	1,028	0	1,025	0	0	0

Table 7. The lower Colorado River (Reach 1) total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m²), by year for YOY Colorado pikeminnow caught during young-of-year monitoring for the period of 1986—2010. Missing data is being compiled from original records.

Reach 1	YOY Colorado	Mean Length	Length Range	Total Area	CPUE
Year	Pikeminnow	(mm)	(mm)	(m²)	(fish/100m²)
	Caught				
1986	192	27.86	17-36	1343.6	14.29
1987	176	40.93		2225.8	7.91
1988	172	47.98		3786.8	4.54
1989	132	42.67		3739.2	3.53
1990	179	41.90		2565.8	6.98
1991	150	34.17		2271	6.61
1992	151	33.55		3663.2	4.12
1993	206	32.28	22-47	2858.8	7.21
1994	142	64.07	32-96	3139.8	4.52
1995	85	20.46	11-35	2890	2.94
1996	866	39.6	20-81	4113.8	21.05
1997	12	18.3	13-34	2774.8	0.43
1998	88	34.5	20-60	4663.8	1.89
1999	13	25	19-43	4710	0.28
2000	398	45.7	25-82	6389.6	6.23
2001	17	42.3	23-65	4046.8	0.42
2002	25	57.2	32-87	3033.8	0.82
2003	0	N/A	N/A	2837.8	0.00
2004	16	47	33-63	1620	0.99
2005	19	36.1	28-48	1722	1.10
2006	4	42	27-53	1682.4	0.24
2007	24	37.2	28-47	2802	0.86
2008	0	N/A	N/A	2568	0.00
2009	243	32.75	15-63	2193.4	9.46
2010	27	35.93	26-61	2630.4	1.03

Table 8. The lower Colorado River (Reach 1), total captures by year for native and endangered fish during young-of-year monitoring on 1986-2010. Species listed are: YOY Colorado pikeminnow (CS YOY; 10-99mm), juvenile pikeminnow (CS JUV; 100-399 mm), unidentified *Gila* spp.(CH), Bonytail (BT), humpback chub (HB), flannelmouth sucker (FM), bluehead sucker (BH), and speckled dace (SD). In most years species other than CS were only enumerated during the first haul within primary backwaters.

Year	CS YOY	CS JUV	CH	BT	HB	FM	BH	SD
1986	192	0	194	0	0	0	0	41
1987	176	2	27	0	0	2	7	2
1988	172	37	11	0	0	4	0	0
1989	132	7	130	0	0	2	3	2
1990	179	11	6	0	0	4	2	0
1991	150	0	8	0	0	1	0	5
1992	151	1	45	0	0	2	25	9
1993	206	3	216	0	0	69	198	23
1994	142	0	15	0	0	0	11	1
1995	85	0	119	0	0	2	176	28
1996	866	0	30	0	0	3	87	29
1997	12	0	4	0	0	1	12	4
1998	88	0	11	0	0	1	8	9
1999	13	2	1	0	0	0	1	0
2000	398	9	21	0	0	1	58	0
2001	17	0	1	0	0	0	0	1
2002	25	0	35	0	0	0	1	0
2003	0	0	0	0	0	0	0	0
2004	16	0	4	0	0	9	5	0
2005	19	0	0	0	0	0	0	0
2006	4	0	0	0	0	9	1	3
2007	24	0	0	0	0	2	0	0
2008	0	0	0	0	0	4	8	0
2009	243	0	0	0	0	5	3	1
2010	27	3	2	0	0	15	0	0

Table 9. The lower Colorado River (Reach 1), total captures by year for nonnative fish during young-of-year monitoring on 1986-2010. Only fish enumerated in the first haul within each primary backwater are counted in these totals to provide consistency among years and reaches. Species listed are: black bullhead (BB), black crappie (BC), bluegill (BG), channel catfish (CC), common carp (CP), fathead minnow (FH), gambusia (GA), green sunfish (GS), gizzard shad (GZ), largemouth bass (LG), northern pike (NP), plains killifish (PK), red shiner (RS), smallmouth bass (SM), sand shiner (SS), walleye (WE), white sucker (WS), and yellow bullhead (YB).

YEAR	BB	BC	BG	CC	CP	FH	GA	GS	GZ	LG	NP	PK	RS	SM	SS	WE	WS	YB
1986	0	0	0	4	0	456	2	0	0	1	0	6	1,077	0	240	0	0	0
1987	1	0	0	10	1	233	1	0	0	0	0	0	2,159	0	428	0	0	0
1988	0	0	0	0	4	10,650	0	1	0	0	0	36	1,786	0	2,161	0	0	0
1989	11	0	0	8	12	3,613	0	2	0	0	0	9	6,973	0	951	0	1	0
1990	2	0	2	11	4	5,698	1	1	0	1	0	10	6,593	0	889	0	0	0
1991	1	0	0	8	1	2,632	0	0	0	0	0	6	4,368	0	1,652	0	1	0
1992	1	0	0	0	1	2,809	2	7	0	0	0	7	6,470	0	3,991	0	1	0
1993	3	0	0	1	8	2,091	4	1	0	0	0	0	3,870	0	1,449	0	2	0
1994	1	0	0	1	2	4,795	14	34	0	0	0	0	4,393	0	2,520	0	2	0
1995	2	0	0	17	3	1,105	71	2	0	1	0	0	1,079	0	926	0	0	0
1996	0	0	2	1	0	2,591	3	15	0	1	0	8	3,851	0	5,998	0	0	0
1997	0	0	0	12	2	37	3	0	0	2	0	0	1,244	0	224	0	0	0
1998	0	0	0	1	0	265	1	6	0	0	0	2	6,297	0	8,751	0	0	0
1999	0	1	1	21	3	137	1	1	0	0	0	2	1,891	0	2,303	0	0	0
2000	4	0	0	0	1	1,265	24	2	0	1	0	0	15,099	0	22,343	0	1	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	1	0	0	4	3	4,963	1	0	0	0	0	1	11,691	0	2,920	0	0	0
2003	2	0	0	0	1	2,192	4	0	0	0	0	7	788	0	1,162	0	0	0
2004	0	0	0	0	1	352	0	0	0	0	0	0	625	0	535	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	1	2	0	4	1	159	94	10	0	2	0	1	3,030	0	103	0	0	1
2007	1	0	0	1	5	597	52	0	15	0	0	0	1,063	1	0	0	6	0
2008	0	0	0	1	5	280	1	0	17	1	0	0	536	0	5	0	1	1
2009	3	7	0	0	6	260	36	0	57	0	0	0	3,124	0	12	0	0	0
2010	0	0	0	2	0	377	3	0	174	5	0	0	657	0	622	1	0	0



USGS 09315000 GREEN RIVER AT GREEN RIVER, UT

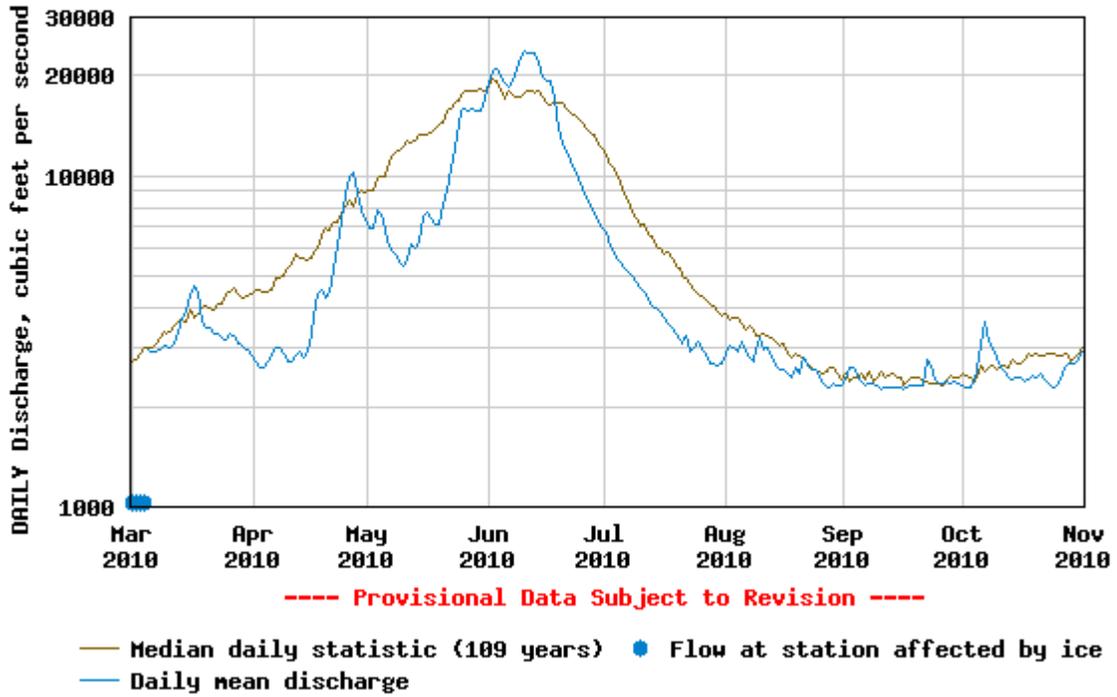


Figure 1. The lower Green River (Reach 3) daily mean flows measured from USGS Gage #09315000 at Green River, Utah from March 1, 2010 to November 1, 2010.



USGS 09180500 COLORADO RIVER NEAR CISCO, UT

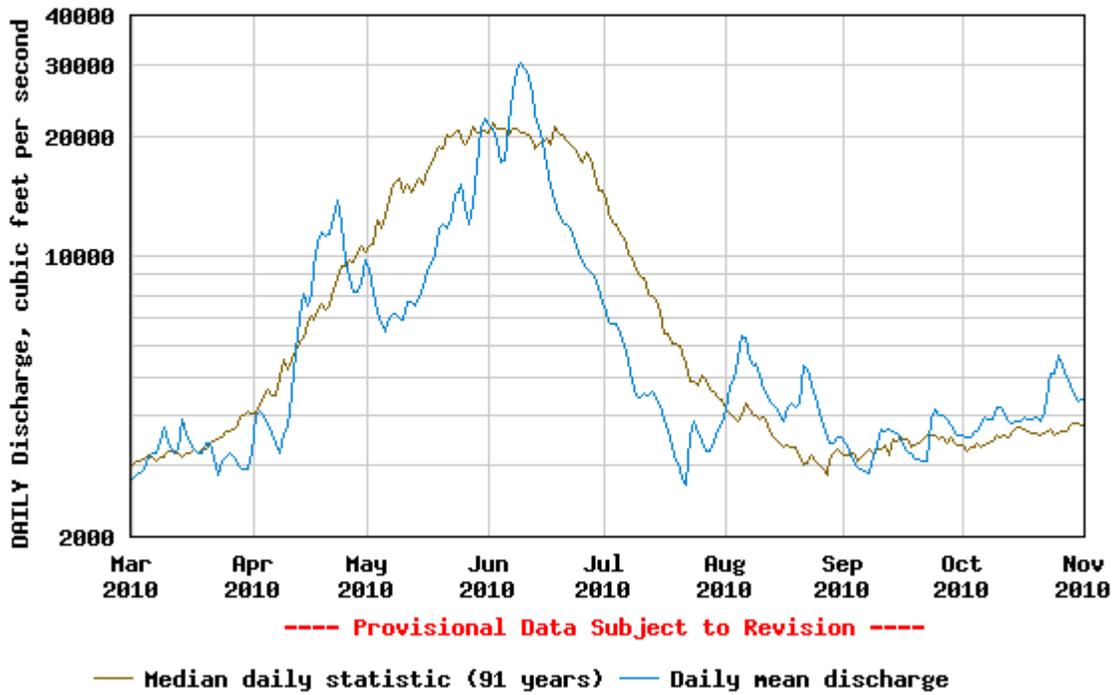


Figure 2. The lower Colorado River (Reach 1) daily mean flows measured from USGS Gage #09180500 near Cisco, Utah from March 1, 2010 to November 1, 2010.