

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

II. Principal Investigator(s):

Paul Badame/Katie Creighton  
Utah Division of Wildlife Resources  
Moab Field Station  
1165 S. Highway 191 - Suite 4  
Moab, UT 84532  
435-259-3780; fax: 435-259-3785  
email: paulbadame@utah.gov  
kathrinecreighton@utah.gov

Trina Hedrick/Leisa Monroe  
Utah Division of Wildlife Resources  
152 East 100 North  
Vernal, UT 84078  
435-789-3103; fax: 435-789-8343  
email: trinahedrick@utah.gov  
leisamonroe@utah.gov

Dr. Kevin Bestgen  
Larval Fish Laboratory  
Department of Fishery and Wildlife Biology  
Room 33 Wagar Building  
Colorado State University  
Fort Collins, CO 80523-1474  
970-491-1848/(fax) 970-491-5091  
email: kbestgen@lamar.colostate.edu

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 will be 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 Colorado pikeminnow / small-bodied fishes abundance and correlations with flow and temperature.

- 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 2009 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 2009):

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 2009):

#### Task 1: Middle Green River: Reach 4

Annual monitoring for YOY Colorado pikeminnow began on 22 September and was completed on 1 October 2009. 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 river-mile 215 (Sand Wash). Not all 5-mile sub-reaches contained three backwaters and 58 of a possible 63 backwaters were sampled. Main channel temperatures ranged from 11.2°C to 19°C. Backwater temperatures ranged from 11.5°C to 21.5°C. Green River discharge (as measured at the Jensen gauge) ranged from 2,470 cfs to 2,570 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 – 2008). Conditions in 2009 were slightly different than during the 2008 sampling effort. Sampling in 2008 began on 24 September and ended on 5 October. Temperatures over this time ranged from 14.0°C to 20.8°C in the main channel and 14°C to 24.4°C in the backwaters. Green River discharge ranged from 2,060 – 2,110 cfs during the period of sampling in 2008.

In the first two backwaters in each five-mile sub-reach, 325 YOY Colorado pikeminnow were captured, measured, and released (two of these were not doing well and were actually preserved and sent to the Larval Fish Lab). An additional 316 YOY pikeminnow were captured in the third backwater. Additional information on tertiary backwater fish captured during project #144, Native Fish Response, are included in the report for that project this year. Next year, those results will also be reported herein. Young-of-year Colorado pikeminnow averaged 43.7 mm (primary and secondary backwaters only). Lengths ranged from 22 - 71 mm (Table 1). One juvenile Colorado pikeminnow was captured in a tertiary backwater with a total length (TL) of 148 mm.

Additional YOY native species collected include (primary backwaters only): flannelmouth sucker ( $n = 52$ ), bluehead sucker ( $n = 36$ ), speckled dace ( $n = 1$ ), and roundtail chub ( $n = 13$ ) (Table 2). Seine samples continue to be dominated by nonnative cyprinids including red shiner, fathead minnow and sand shiner. However, red and sand shiner numbers appeared to be down dramatically from high abundance years such as 2006. There were a total of 12 nonnative species collected in seine samples (in comparison to nine in 2005, 12 in 2006, 13 in 2007 and 14 in 2008). Nonnative species collected (primary backwaters and first seine hauls only) include fathead minnow ( $n = 108$ ), carp ( $n = 17$ ), green sunfish ( $n = 1$ ), red shiner ( $n = 2101$ ), smallmouth bass ( $n = 1$ ), sand shiner ( $n = 417$ ), white sucker ( $n = 5$ ), black crappie ( $n = 4$ ), and gizzard shad ( $n = 2$ ). Additional species collected during this effort include black bullhead, channel catfish, and brook stickleback.

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

Annual monitoring for YOY Colorado pikeminnow in reach 3 began on September 13 and was completed on September 16, 2009. Seining was conducted on the Green River from river-mile 120 (Green River State Park) to river-mile 0 (confluence with the Colorado River). Samples were collected at two backwater habitats within every 5-mile sub-reach, as available. A total of 35 of 48 possible backwaters were sampled in 20 of 24 sub-reaches in the lower Green River. Reach 3 water temperatures ranged from 19.5 to 23.5 °C in the main channel and 19 to 24 °C in backwaters. Lower Green River flows (measured at the Green River gauge) ranged from 2900 cfs to 2600 cfs over the four days of sampling.

In the lower Green River, 423 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 greater than in 2008 (60 fish). This is considerably greater than the 10-year average of 23.65 fish but closer to the 15-year average of 228.4 fish (Table 4). The CPUE this year was 16.6 fish/100m<sup>2</sup>, higher than the ten-year average of 7.3 fish/100m<sup>2</sup> (Table 4). The average length of YOY Colorado pikeminnow was 35.32 mm, which is slightly below the ten-year average length of 43.59 mm (Table 2).

Other native species captured in the lower Green River were 1 *Gila* spp. and 2 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. Six nonnative species were present compared to the nine found in 2008 (Table 6). These included red shiners (n = 2766), fathead minnows (n = 1044), sand shiners (n = 15), channel catfish (n = 3), and gizzard shad (n = 1).

### Task 3: Colorado River (Reach 1)

Annual monitoring for YOY Colorado pikeminnow in reach 1 began on September 13 and was completed on September 18, 2009. Seining on the Colorado River was conducted from river-mile 110 (Cisco Landing) to river-mile 0 (Confluence with the Green River). Backwater habitats were sampled within every 5-mile sub-reach, as available. A total of 31 of 44 possible backwaters were sampled in 17 of 22 sub-reaches in the Colorado River. Water temperatures in Reach 1 ranged from 17.5 to 22 °C in the main channel and 17 to 23.5 °C in backwaters. Colorado River flows (measured near Cisco) ranged from 3100 cfs to 4000 cfs over the 6 days of sampling.

In the Colorado River, 243 YOY Colorado pikeminnow were captured and measured. All fish were sorted, identified and enumerated in the field. The number of Colorado pikeminnow captured is higher than in 2008 when zero YOY Colorado pikeminnow were captured (Table 7). It is also higher than both the ten-year average of 51.6 fish and the 15-year average of 104.9 fish. The CPUE this year was 9.46 fish/100m<sup>2</sup>, which is significantly higher than the ten-year average CPUE of 1.64 fish/100m<sup>2</sup> as well as the 15-year average CPUE of 2.86 fish/100m<sup>2</sup> (Table 7). The average length of YOY Colorado pikeminnow was 32.75 mm, which is slightly lower than the 10-year average of 34.03 mm (Table 7).

Other native species captured in the Colorado River included 5 flannelmouth suckers, 3 bluehead suckers, and 1 speckled dace (Table 8).

Nonnative captures were again only enumerated during the first seine haul in each primary habitat in the Colorado River, eight nonnative species were captured compared with eleven nonnative captured in 2008 (Table 9). These included red shiners (n = 3,124), gizzard shad (n = 57), fathead minnows (n = 260), gambusia (n = 36), sand shiners (n = 12), black crappie (n = 7), common carp (n = 1), black bullheads (n = 3), channel catfish (n = 3), largemouth bass (n = 1), bluegill (n = 1), and white suckers (n = 1). An additional 350 gizzard shad were counted during in primary hauls of secondary backwaters.

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 13, 2009.

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. The abundance of gizzard shad is increasing in backwaters sampled within both the middle Green and lower Colorado rivers. A more comprehensive analysis of gizzard shad distribution for both adults and juveniles will be assembled from various sampling efforts throughout the basin by January 2010.

VIII. Project Status:

On track and ongoing

IX. FY 2009 Budget Status

- A. Funds Provided: \$71,561
- B. Funds Expended: \$71,561
- C. Percent of the FY 2009 work completed: 100%
- D. 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 2010.

XI. Signed: Paul Badame & Trina Hedrick November 10, 2009  
Investigator Date

Table 1. The middle Green River (Reach 4) total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m<sup>2</sup>), by year for YOY Colorado pikeminnow caught during young-of-year monitoring for the period of 1990—2009. *To be consistent with previous years, information in this table contains only those individuals captured in the first two backwaters of a subreach.*

<b>Year</b>	<b>Colorado Pikeminnow Caught</b>	<b>Mean Length (mm)</b>	<b>Length Range (mm)</b>	<b>Total Area Sampled (m<sup>2</sup>)</b>	<b>CPUE (Fish/100m<sup>2</sup>)</b>
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

Table 2. The middle Green River (Reach 4), total captures by year for native and endangered fish during young-of-year monitoring on 1986-2009. Colorado pikeminnow numbers captured are from primary and secondary backwaters sampled in each subreach; other native fish numbers captured are from only primary backwaters in each subreach. In some years, species other than Colorado pikeminnow were only enumerated during the first haul within primary backwaters; inconsistencies are being sorted using original data sheets. Species listed are: YOY Colorado pikeminnow (CS YOY; 10-99mm), juvenile pikeminnow (CS JUV; 100-399 mm), unidentified *Gila* spp. (CH), Bonytail (BT), roundtail chub (RB), flannelmouth sucker (FM), bluehead sucker (BH), and speckled dace (SD).

<b>Year</b>	<b>CS YOY</b>	<b>CS JUV</b>	<b>CH</b>	<b>BT</b>	<b>RT</b>	<b>FM</b>	<b>BH</b>	<b>SD</b>
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

\*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. The middle Green River (Reach 4), total captures by year for nonnative fish during young-of-year monitoring 1987 -2009. Only fish enumerated in primary backwater first seine hauls are included (some inconsistencies do exist as beginning in 1991; these are being worked out using original data sheets). 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
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

Table 4. The lower Green River (Reach 3) total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m<sup>2</sup>), by year for YOY Colorado pikeminnow caught during young-of-year monitoring for the period of 1986—2009.

<b>Reach 3</b>	<b>YOY Colorado</b>	<b>Mean Length</b>	<b>Length Range</b>	<b>Total Area</b>	<b>CPUE</b>
<b>Year</b>	<b>Pikeminnow</b>	<b>(mm)</b>	<b>(mm)</b>	<b>(m<sup>2</sup>)</b>	<b>(fish/100m<sup>2</sup>)</b>
	<b>Caught</b>				
1986	813			1964	41.40
1987	849			2831.8	29.98
1988	2892			3076.4	94.01
1989	1494			4261.8	35.06
1990	418			6516.6	6.41
1991	186			2822.2	6.59
1992	122			5181.6	2.35
1993	1616			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

Table 5. The lower Green River (Reach 3), total captures by year for native and endangered fish during young-of-year monitoring on 1986-2009. 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, inconsistencies are being sorted using original data sheets.

<b>Year</b>	<b>CS YOY</b>	<b>CS JUV</b>	<b>CH</b>	<b>BT</b>	<b>HB</b>	<b>FM</b>	<b>BH</b>	<b>SD</b>
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

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

Table 7. The lower Colorado River (Reach 1) total numbers, lengths and mean catch-per-unit-effort (CPUE; fish/100m<sup>2</sup>), by year for YOY Colorado pikeminnow caught during young-of-year monitoring for the period of 1986—2009. Missing data is being compiled from original records.

<b>Reach 1</b>	<b>YOY Colorado</b>	<b>Mean Length</b>	<b>Length Range</b>	<b>Total Area</b>	<b>CPUE</b>
<b>Year</b>	<b>Pikeminnow</b>	<b>(mm)</b>	<b>(mm)</b>	<b>(m<sup>2</sup>)</b>	<b>(fish/100m<sup>2</sup>)</b>
	<b>Caught</b>				
1986	192			1343.6	14.29
1987	176			2225.8	7.91
1988	172			3786.8	4.54
1989	132			3739.2	3.53
1990	179			2565.8	6.98
1991	150			2271	6.61
1992	151			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

Table 8. The lower Colorado River (Reach 1), total captures by year for native and endangered fish during young-of-year monitoring on 1986-2009. 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, inconsistencies are being sorted using original data sheets.

<b>Year</b>	<b>CS YOY</b>	<b>CS JUV</b>	<b>CH</b>	<b>BT</b>	<b>HB</b>	<b>FM</b>	<b>BH</b>	<b>SD</b>
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

Table 9. The lower Colorado River (Reach 1), 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	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