COLORADO RIVER RECOVERY PROGRAM
FY 2012 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: _22f_

I. Project Title: INTERAGENCY STANDARDIZED MONITORING PROGRAM (ISMP) ASSESSMENT OF ENDANGERED FISH REPRODUCTION IN RELATION TO FLAMING GORGE OPERATIONS IN THE MIDDLE GREEN AND LOWER YAMPA RIVERS-Yampa and middle Green River assessment of Colorado pikeminnow and razorback sucker larvae

II. Bureau of Reclamation Agreement Number(s): R09AP40859 / 09FG402859

Project/Grant Period: Start date (Mo/Day/Yr): 1 Oct. 2008
End date: (Mo/Day/Yr): 30 Sept. 2014
Reporting period end date: 30 Sept. 2012
Is this the final report? Yes _____ No _X___

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IV. Abstract: The goal of Flaming Gorge flow and temperature recommendations (Muth et al., 2000) that were implemented in 2006 was to improve the status and prospects for recovery of endangered fish populations in the Green River. A major emphasis of those recommendations was to enhance the reproductive and recruitment success of endangered fishes in the middle Green River, in particular razorback sucker and Colorado pikeminnow. Larvae of razorback sucker *Xyrauchen texanus* and Colorado pikeminnow *Ptychocheilus lucius* were captured in the Green River basin in spring and summer 2011. Razorback sucker sampling was conducted with light traps primarily in the Green River between Jensen and Ouray and Colorado pikeminnow sampling was with drift nets in the lower Yampa River. Sampling was designed to provide a measure of timing of reproduction and a measure of annual reproductive success of each species. Diel variation in abundance of Colorado pikeminnow larvae in the drift was also assessed. This data will be used to assess effects of flow and temperature regimes on reproduction by razorback sucker and Colorado pikeminnow and to correlate abundance of larvae to abundance of juveniles in autumn.

V. Study Schedule: Ongoing in this agreement since 2008, similar sampling has been conducted since 1990, in most years. Anticipate continued annual sampling.

VI. Relationship to RIPRAP: Relationship to specific RIPRAP items:

Green River Action Plan: Mainstem

I. Provide and protect instream flows--habitat management.
I.A. Green River above Duchesne River.
I.A.1. Initially identify year-round flows needed for recovery while providing experimental flows.
I.A.2.a. Summer/fall flow recommendations.
I.A.3. Deliver identified flows.
I.A.3.a. Operate Flaming Gorge pursuant to the Biological Opinion to provide summer and fall flows.
I.A.3.d. Operate Flaming Gorge Dam to provide winter and spring flows and revised summer/fall flows, if necessary.
I.B. Green River below the Duchesne River.
I.B.1. Initially identify year-round flows needed for recovery while providing experimental flows.
I.B.2. State acceptance of initial flow recommendations.
I.B.2.a. Review scientific basis.
II. Restore habitat--habitat development and maintenance.
II.A. Restore and manage flooded bottomland habitat.
II.A.1. Conduct site restoration.
II.A.1.a. Old Charlie Wash.
II.A.1.a.(3) Monitor and evaluate success.
II.C. Enhance water temperatures to benefit endangered fishes.
II.C.1. Identify options to release warmer water from Flaming Gorge Reservoir to restore native fish habitat in the Green River.
V. Monitor populations and habitat and conduct research to support recovery actions--research, monitoring, and data management.
V.A. Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

Green River Action Plan: Yampa and Little Snake Rivers

I. Provide and protect instream flows--habitat management.
I.D. Yampa River below Little Snake River.
I.D.1. Initially identify year-round flows needed for recovery.
I.D.2. Evaluate need for instream flow water rights.
I.D.2.a. Review scientific basis.

Green River Action Plan: Yampa and Little Snake Rivers

V.A.1. Conduct standardized monitoring.
V.B.2. Conduct appropriate studies to provide needed life history information.

VII. Accomplishment of FY 2012 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings: Project Objectives

1). Determine timing and duration of spawning by razorback sucker and presence and abundance of larvae in the system as measured by capture of larvae in light traps. Sampling was extended to the White River this year. Additional sampling was also conducted in flood plain wetlands in early summer and autumn under this project.

2). Determine timing and duration of spawning by Colorado pikeminnow and presence and abundance of larvae in the system as measured by capture of larvae downstream of spawning areas in the lower Yampa River.

Task Description (FY 2012)

I). Collect light trap samples for razorback sucker. The Colorado River Fishery Project (CRFP) office in Vernal was responsible for this task.
II). Collect drift net samples for Colorado pikeminnow. The Larval Fish Laboratory (LFL) was responsible for this task.
III). Identify light trap and drift net samples. Preliminary identifications will be conducted by the responsible sampling entity, with assistance from the LFL, as samples are collected to provide real-time data. Final specimen identification and curation will be conducted by the LFL.
IV). Summarize specimen data collection in an annual report.

Accomplishments by Task.

I). Collect light trap samples for razorback suckers. Light trap samples were collected during May, June, and July 2012 by the Vernal CRFP. Additional sampling in the White River and Green River flood plain wetlands was also conducted in summer and autumn 2012.

II). Collect drift net samples for Colorado pikeminnow. Drift net samples were collected during June to August 2012 by the LFL.

III). Identify light trap and drift net samples.

Middle Green River light trap samples, 2012. Samples sent to the Larval Fish Laboratory have been received and are being identified by the Larval Fish Laboratory. The duration of the sampling season was 7 May until 21 June, 2012. First razorback sucker larvae of the season were captured on 16 May at several locations, which was relatively early but not unexpected in that low flow and relatively warm water year. That date of first appearance was in contrast to2011

when the first larvae were detected on 24 June. Flows in 2011 were extremely high and cold, which greatly delayed reproduction by razorback sucker.

Additional 2011 Results. Several new findings were documented in 2011, many of which were not reported on earlier because samples were not identified. First, early life stage sampling was conducted in the White River in late spring and early summer. We sampled five sites in the lower 29.3 river kilometers (RK) of the White River with light traps (Muth and Haynes 1984; Mueller et al. 1993). Seventy-six light trap samples were collected from low velocity channel margin habitat, including backwaters, from 16 June to 4 August 2011. Light traps were typically set in early evening, and samples were collected the next day, usually in the morning. Flows in the White River were very high during spring and early summer 2011 and reached a peak flow of 146 cubic meters per second (m^3/s) at the USGS 09306500 gage near Watson, Utah, which created several off-channel areas for sampling. Water temperatures during the sampling period were 14–25.5 ºC, and diel fluctuations of up to 7.5 ºC were noted. All fish in light trap samples were preserved in 100% ethanol and were transported to the lab for preliminary identification. Verification of identity of fishes was conducted at the Larval Fish Laboratory, Colorado State University, using published guides (e.g., Snyder 1981; Snyder and Muth 2004; Snyder, D. E. and R. T. Muth. 2004. Catostomid fish larvae and early juveniles of the upper Colorado River basin - morphological descriptions, comparisons, and computer-interactive key. Colorado Division of Wildlife Technical Publication 42). Fishes were counted and measured to the nearest millimeter total length (mm TL) and cataloged into the collection at the LFL.

A total of 2,093 fish in 12 species (six native and six non-native) were collected in light trap samples from the White River in 2011 (Table 1). Of that total, 767 (36.6%) were native fishes and 750 were native catostomids. Of those native catostomids, 56 were razorback sucker larvae and early juveniles, including 48 that were identified with high certainty and eight that were identified as "razorback sucker?" (larvae that were identified as razorback sucker but having one or more characteristics that were slightly different than typical larvae, hereafter called razorback sucker). No razorback sucker was captured at the most downstream site (RK 2.3), which received relatively little sampling effort (8 of 76 samples), but 44 were captured from the next most downstream site at RK 8.7, nine were captured at RK 23.8, one at RK 24.3, and two at RK 29.3. Razorback sucker were captured from 16 June to 4 August, with a peak in captures on 6 July (n=18) and had mean length of 16.4 mm TL (10–35 mm TL). The earliest larvae captured was 12 mm TL, indicating recent hatching (about 2 weeks old based on age at size data, Bundy and Bestgen 2001; Bestgen et al. 2011), but 13 mm TL larvae were captured as late as 12 July, indicating spawning occurred relatively late in summer (e.g., late June). The two largest razorback suckers captured measured 34 and 35 mm TL, and were identified as "razorback sucker?".

We also captured a single Colorado pikeminnow larva at RK 29.3 on 4 August that was 11 mm TL. Length at age and growth rate information suggested

that this larva was likely spawned in early July (Bestgen 1996; Bestgen and Bundy 1998; Bestgen et al. 2007). Additional sampling on 4 August with seines at RK 29.3 yielded a 110 mm TL Colorado pikeminnow, which was likely spawned in 2010.

A much expanded sampling program was undertaken in spring-autumn 2011 to document potential use of early life stages of razorback sucker in flood plain wetlands in the middle Green River. This was conducted because high and extended flows created many and large flood plain wetlands that had long connections with the Green River. Because flows were high and cold late in 2011 we documented relatively late first reproduction by razorback sucker - 24 June - in the middle Green River in 2011. Additional sampling in flood plain wetlands was conducted in summer and autumn to determine if larvae were entrained in flood plain wetlands and if they survived through summer. Several juvenile razorback sucker were captured in Wyasket Lake by Aaron Webber (USFWS, Vernal, Utah) in September 2011, and are thought to be wild-produced fish. In addition, three juvenile razorback sucker were captured in Leota4 wetland in the middle Green River in September. We extracted otoliths from the three juvenile razorback sucker and aged them (using daily increment counts). The idea regarding aging was to evaluate whether these fish were potentially hatchery fish (because of some connection of the hatchery with the Leota wetlands) or if they were wild fish. Hatchery fish are typically spawned relatively early in the year and should be quite old relative to wild fish; hatchery fish at Ouray hatched on 5 May in 2011. Thus, a hatchery larva hatched on 5 May and captured on 8 September would be 126 days old. Recall that our first verified collection of Green River razorbacks was on 24 June, much later, and wild-caught larvae are typically 12–14 days old when captured, owing to incubation time following hatching (9–12 days) and time to get into a trap (one to a few days). Thus, first captured fish should have hatching dates of about 10–14 June.

The juveniles were 108.5, 82.3, and 103.7 mm TL, the first was captured on 8 September and the other two on 9 September. The first fish was aged at 90 days by A. A. Hill, and K. Bestgen verified this estimate (91 days). The other two were aged at 87 or 88 days and 88 or 89 days, respectively. This puts the hatching dates of those three fish at 10 June, 13 June, and 12 June, respectively. If one adds 10 to 14 days (use 12) to those to represent the incubation/emergence times, you get a range of dates from 22–26 June, which corresponds with the onset of first captures in the Green River. Thus, the Leota 4 fish were undoubtedly wild produced fish. In addition, the growth rates were consistent with faster growth of flood plain wetland fish, as growth rates were on the order of 1 mm a day.

Middle Green River light trap samples, 2011. Samples sent to the Larval Fish Laboratory were identified. A total of 255 samples, including several seine samples, were collected in 2011. Sampling began on 11 May and ended on 5 August. A total of 243 razorback sucker larvae were captured in 2011; 242 of those were collected in light traps and were 11–21 mm TL. One specimen was

collected by a seine on 3 August and was relatively large at 34 mm TL. Abundance trends for razorback sucker larvae captured in light trap samples in the middle Green River, Utah, are reported in Figure 1. The first razorback sucker larvae captured in the middle Green River in 2010 was on 27 June, which was the latest first of season razorback sucker larva ever captured (Bestgen et al, 2011). The last razorback sucker larva (9 mm TL) was captured on 21 July, indicating a long and late spawning season. Large numbers of razorback sucker larvae continue to be captured during light trap sampling in the middle Green River since 2004, indicating continued reproductive success of stocked fish. The number captured in 2011 is perhaps a conservative estimate of the abundance of larvae in the Green River system that year, given that high flows and the large amount of floodplain wetland habitat available likely widely dispersed larvae.

Lower Yampa River drift net sampling, 2012. Samples were collected in the Yampa River about 0.2 to 0.8 kilometers (km) upstream from the Green River (n=285 total samples collected in 2012), the same site that samples were collected from 1990 to 1996 (Bestgen et al. 1998) and in 1998 to 2011. Exploratory sampling occurred on 26 and 29 May; regular sampling commenced on 6 June and extended through 14 August. The first Colorado pikeminnow larva was collected on 20 June 2012; preliminary identification of samples has been completed but verification remains so numbers of Colorado pikeminnow larvae captured is not known with certainty. However, it looked to be a relatively strong year for reproduction for Colorado pikeminnow as many larvae were captured and the spawning season was very long. Final verification of samples is underway.

Lower Yampa River drift net sampling, 2011. Samples were collected in the Yampa River about 0.2 to 0.8 km upstream from the Green River (n=182 total samples, 2011), the same site that samples were collected from 1990 to 1996 (Bestgen et al. 1998) and in 1998 to 2010. A total of 4,952 total fishes were collected. First Colorado pikeminnow larvae were detected in a limited number of samples analyzed on 24 July, a late first capture date relative to other sampling years. The last Colorado pikeminnow captured was on 26 August (9 mm TL), and represents the latest date for reproduction by Colorado pikeminnow known. A total of 443 Colorado pikeminnow larvae were captured in 2011with a peak in abundance from 1–4 August. Subsequent seine sampling in backwaters in nursery habitat downstream in the Jensen–Ouray reach of the Green River (ISMP sampling, Project 138) suggested very low survival of larvae to autumn 2011 as no young-of-year Colorado pikeminnow were collected.

VIII. Recommendations: Continue sampling as planned in 2013.

IX. Project Status: Ongoing and on-track.

X. FY 2012 Budget Status

A. Funds Provided: $130,487
B. Funds Expended: $ 115,400
C. Difference: 15,087 remaining funds for sample analysis
D. Percent of the FY 2011 work completed, and projected costs to complete: About 70% complete.
E. Recovery Program funds spent for publication charges: None.

XI. Status of Data Submission (Where applicable): Data were made available to investigators.

XII. Signed: Kevin R. Bestgen 7 November 2012
Principal Investigator Date

APPENDIX: A major product based on these data was produced and finalized in 2011:

Bestgen, K. R., G. B. Haines, and A. A. Hill. 2011. Synthesis of flood plain wetland information: Timing of razorback sucker reproduction in the Green River, Utah, related to stream flow, water temperature, and flood plain wetland availability. Final report to the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin. U. S. Fish and Wildlife Service, Denver, CO. Larval Fish Laboratory Contribution 163.

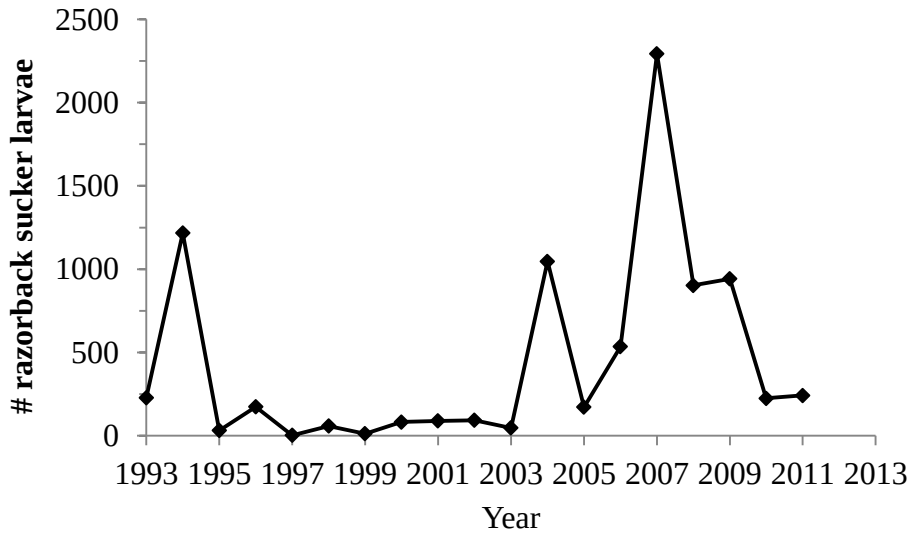

Figure 1. Number of razorback sucker larvae captured from 1993 to 2011 in the middle Green River, Utah, in light traps (all fish including those of questionable taxonomic identity included; 2012 sample identification is underway).

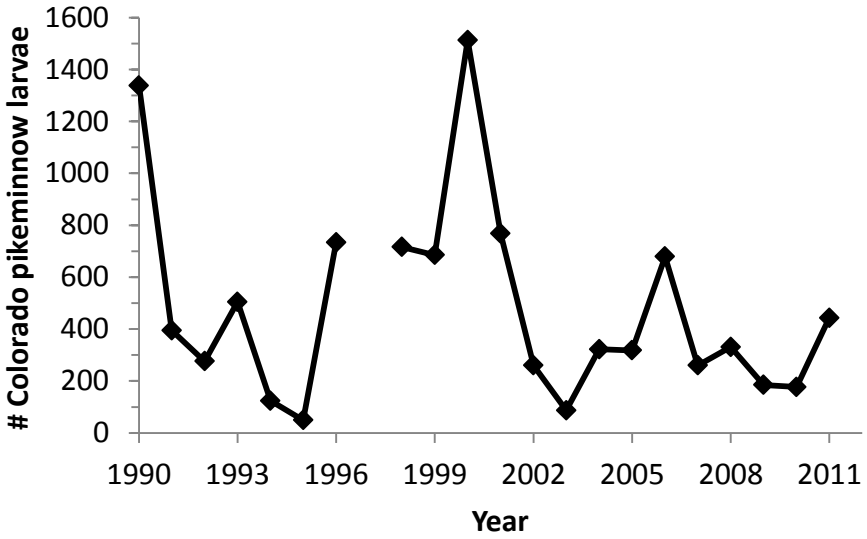

Figure 2. Number of Colorado pikeminnow larvae captured from 1990 to 2011 (no sampling in 1997, includes specimens from all diel samples, 2012 sample identification is underway) in the lower Yampa River, Colorado, during summer in drift nets.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: __R09AP40859 / 09FG402859_

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: _22f____

Project Title: INTERAGENCY STANDARDIZED MONITORING PROGRAM (ISMP) ASSESSMENT OF ENDANGERED FISH REPRODUCTION IN RELATION TO FLAMING GORGE OPERATIONS IN THE MIDDLE GREEN AND LOWER YAMPA RIVERS.

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Project/Grant Period: Start date (Mo/Day/Yr): 1 Oct. 2008
End date: (Mo/Day/Yr): 30 Sept. 2014
Reporting period end date: 30 Sept. 2012
Is this the final report? Yes _____ No _X___

Performance: The goal of this project is to document timing and intensity of reproduction by razorback suckers and Colorado pikeminnow in the lower Yampa and middle green rivers. In 2012 we collected 285 drift net samples and additional seine samples in the lower Yampa River. In addition, we identified samples collected by the U. S. Fish and Wildlife Service in 2011 and began sample identification for 2012 samples. Another objective of this project is to summarize data collections. This was done in the attached report.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R10PG40061

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 22f

Project Title: INTERAGENCY STANDARDIZED MONITORING PROGRAM (ISMP) ASSESSMENT OF ENDANGERED FISH REPRODUCTION IN RELATION TO FLAMING GORGE OPERATIONS IN THE MIDDLE GREEN AND LOWER YAMPA RIVERS.

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End date: (Mo/Day/Yr): 09/30/2012
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Is this the final report? Yes __X___ No ____

Performance: USFWS completed tasks 1 and 3. Light traps were set for 29 nights during the period 8 May through 22 June 2012. Sites included long-term monitoring sites, which have been sampled for the duration of this project, as well as wetland sites inundated during releases from Flaming Gorge. Preliminary identification of light trap samples (task 3) was successfully performed and resulted in near real-time coordination of dam releases with the presence of razorback sucker. As a result, larval razorback sucker were entrained and documented in Old Charley Wash wetland. All samples have been preserved and submitted to Colorado State University Larval Fish Lab for confirming identification and analysis.