COLORADO RIVER RECOVERY PROGRAM
FY 2011 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.

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III. Project Summary: 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. The primary means to achieve enhanced populations will be to pattern flows after a more natural hydrograph, the timing and duration of which will be based on anticipated annual hydrologic conditions and the biology of the fish. Because of vagaries in timing and runoff patterns within and among various hydrologic scenarios, and uncertainties in anticipated effects of flow and temperature recommendations on endangered fishes, Muth et al. (2000) suggested that real-time data be gathered to guide and fine tune operation of Flaming Gorge dam each year. Two existing studies that have provided data to guide operations of Flaming Gorge Dam in the past are "Basin-wide Monitoring Program for Razorback Sucker" (Project 22C) and "Interagency Standardized Monitoring Program (ISMP) Assessment of Colorado Pikeminnow Reproduction and Larval Abundance in the Lower Yampa River, Colorado" (Project 22f). This proposal, which is an extension of portions of those existing studies, is intended to provide some of the necessary real-time data, and add to an extensive dataset that assist with a deeper understanding off the ecology of these endangered fishes.

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 suckers and Colorado pikeminnow and to correlate abundance of larvae to abundance of juveniles in autumn. The data gathered in these studies is being used to conduct two syntheses. The first, using data collected during light trap sampling for razorback sucker larvae since 1992, will examine reproductive patterns and their relationship to spring flows in the middle Green River that are intended to assist in recovery of the species in the middle Green River. The second uses Colorado pikeminnow drift sampling data and autumn ISMP sampling data for juveniles to understand trends in abundance and recruitment over time. A draft of the first synthesis was completed in 2010 and finalized in 2011; the second synthesis is underway, with the drift sampling analysis completed and incorporation of juvenile data is ongoing.

IV. Study Schedule: It is anticipated that this study will continue and be a component of studies designed to evaluate operations of Flaming Gorge Reservoir (see Green River study plan).

V. Relationship to RIPRAP: Reproduction and recruitment of early life stages are critical components of the life history of endangered razorback sucker and Colorado pikeminnow. Understanding trends in reproductive success may help define status of razorback sucker and 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:

<u>Green River Action Plan: Mainstem</u>

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.

VI. Accomplishment of FY 2011 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Project Objectives

1). Determine timing and duration of spawning by razorback suckers 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 2011)**

I). Collect light trap samples for razorback suckers. The CRFP office in Vernal was be responsible for this task.
II). Collect drift net samples for Colorado pikeminnow. The Larval Fish Laboratory 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 2011 by the Vernal CRFP. Additional sampling in the White River and Green River flood plain wetlands was also conducted in summer and autumn 2011.

II). Collect drift net samples for Colorado pikeminnow. Drift net samples were collected during June to August 2011 by the Larval Fish Laboratory.

III). Identify light trap and drift net samples.

**Middle Green River light trap samples, 2011**. Samples sent to the Larval Fish Laboratory have been received and are being identified by the Larval Fish Laboratory.

Several new findings were documented in 2011. First, early life stage sampling was conducted in the White River in late spring and early summer. That sampling was motivated by the finding of ripe razorback suckers during sampling for adult Colorado pikeminnow under project 128. Several low-velocity near-shore areas in the lower White River were sampled with light traps and larvae of razorback suckers were documented in late June. Final results of that sample identification are underway; those larvae represent the first known reproduction by razorback suckers in the White River.

A much expanded sampling program was undertaken in spring-autumn 2011 to document potential use of early life stages of razorback suckers 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 2011we documented relatively late first reproduction by razorback suckers - 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 suckers 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 suckers were captured in Leota4 wetland in the middle Green River in September. We extracted otoliths from the three juvenile razorback suckers 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 total length, 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 a 1 mm a day.

**Middle Green River light trap samples, 2010**. Samples sent to the Larval Fish Laboratory were identified. A total of 225 razorback sucker larvae were captured in 2010. 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 3 June, which was just slightly later than average for first appearance of larvae based on sampling conducted since 1992 (Bestgen et al, 2011). The last razorback sucker larva was captured on 29 June. In comparison, razorback suckers spawned relatively late in the Green River due to high and cool flows late in 2011. 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.

**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, the same site that samples were collected from 1990 to 1996 (Bestgen et al. 1998) and in 1998 to 2010. First pikeminnow larvae were detected in a limited number of samples analyzed on 24 July, a late first capture date relative to other sampling years. Samples are being identified at this time. High flows and water volumes will likely result in relatively low reproduction in terms of numbers of larvae captured in 2011; the value for the index of reproductive success, which accounts for differences in river flow volumes, is unknown at this time.

**Lower Yampa River drift net sampling, 2010**. The first Colorado pikeminnow captured in 2010 was on 8 July and captures extended through 14 August, a

relatively late and protracted spawning period for the second year in a row. We expect 2011 to be similar. Late spawning by Colorado pikeminnow in 2010 was due to relatively high and extended runoff and cooler water temperatures well into summer. A total of 177 Colorado pikeminnow larvae were captured. Abundance trends for Colorado pikeminnow captured in drift nets in the lower Yampa River are reported in Figure 2. The relatively low absolute numbers of larvae captured in 2010 (and 2008 and 2009) are in part, a function of high flows which reduces density of larvae in the river. When corrected for relatively high river flows, capture rates in 2009 were about the historical average for the lower Yampa River, and such will likely be the case for 2010 and 2011 as well.

Three razorback sucker larvae of that were classified as razorback sucker? were captured in 2010 in drift net sampling in the Yampa River. Three razorback sucker larvae (11.4-13.2 mm TL, plus two questionable identity larvae, plus three possible hybrids) were also captured in drift nets in the lower Yampa River from 30 June to 4 July in 2008. Presence of razorback sucker larvae in drift net samples was unusual and likely related to relatively cold and late high flows in the Yampa River in 2008 and 2010. Those same flows were responsible for late reproduction by razorback suckers in the middle Green River as well. Continued reproductive success of razorback suckers in the lower Yampa River may merit additional sampling in the future to document their reproductive success there.

VII. Recommendations: Continue to sample early life stages of razorback sucker and Colorado pikeminnow annually at these sites. This information is critical to establishment of long-term data that can guide informed management decisions regarding population viability and recovery. Data were also used to monitor effects of Flaming Gorge flows and water temperatures in relation to endangered fish reproduction in spring and summer. This information can also be used to make real-time recommendations for flow and temperature regimes for Flaming Gorge Dam during the critical time of reproduction for endangered Colorado pikeminnow. The Recovery Program should increase funding for this project to cover costs for additional sample processing costs incurred for the Green River samples, as well as White River samples. Sampling may also need to be expanded to assess reproduction by razorback suckers in the Yampa River and potentially the Green River.

VIII. Project Status: On track and ongoing. This project was approved for funding in 2012-2013. That information, combined with more sophisticated water temperature data acquisition, should provide some tools for making flow and temperature recommendations to guide operation of Flaming Gorge Reservoir and to assist with fulfilling the Green River study plan. A detailed analysis of the razorback sucker capture data gathered with light trap sampling was included in a synthesis report submitted to the Recovery Program staff in March 2010 and finalized in 2011 (Bestgen et al. 2011). A detailed analysis of the Colorado pikeminnow capture data will be included in a comprehensive report on long-term trends of Colorado pikeminnow abundance in the Green River. Abundance data for age-0 pikeminnow captured in ISMP sampling in autumn are also being incorporated.

IX. FY 2011 Budget Status

A. Funds Provided: $129,492
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.

X. Status of Data Submission (Where applicable): Data will be submitted when identification and analysis is complete.

XI. Signed: Kevin R. Bestgen 12 Nov. 2011
Principal Investigator Date

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.

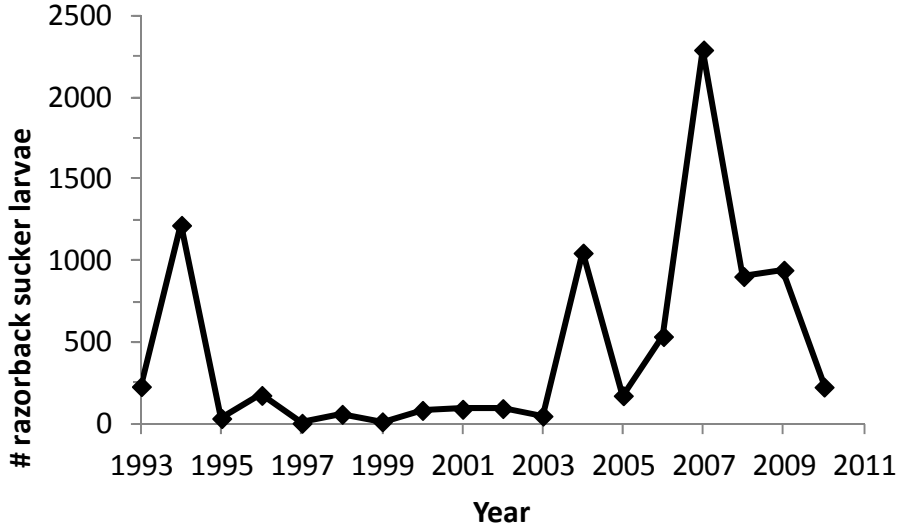


Figure 1. Number of razorback sucker larvae captured from 1993 to 2010 in the middle Green River, Utah, in light traps (all fish including those of questionable taxonomic identity included; 2011 sample identification is nearly complete).

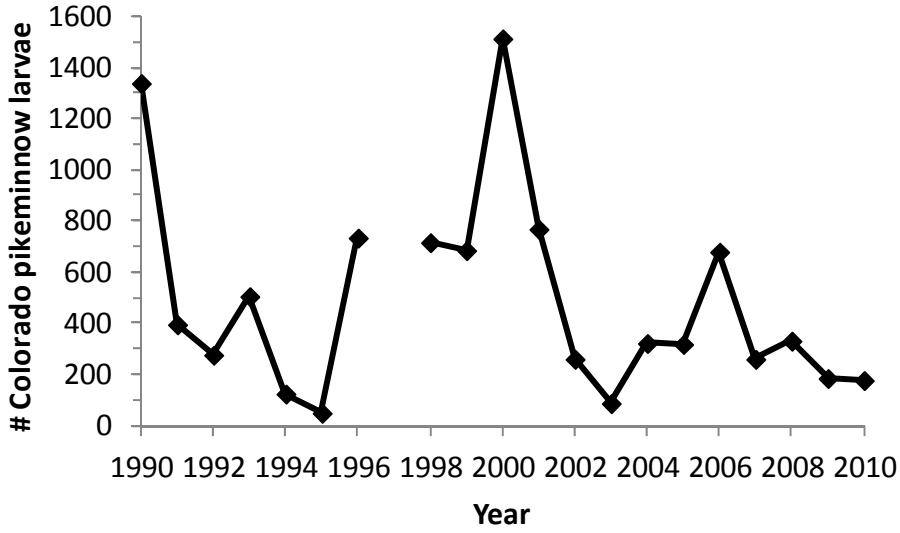


Figure 2. Number of Colorado pikeminnow larvae captured from 1990 to 2010 (no sampling in 1997, includes specimens from all diel samples, 2011 sample identification is underway) in the lower Yampa River, Colorado, in drift nets.