

**COLORADO RIVER RECOVERY PROGRAM
FY 2009-2011 SCOPE OF WORK for:**

Project Number: FR-BW Synth

Data Integration: Historical assessment of factors affecting young Colorado pikeminnow abundance and physical habitat availability in the Green River, Utah.

Lead agency: Larval Fish Laboratory and Argonne National Laboratory

Submitted by: Kevin Bestgen
Larval Fish Laboratory
Department of Fish, Wildlife, and Conservation Biology
Colorado State University
Ft. Collins, CO 80523
voice: KRB (970) 491-1848, JAH (970) 491-2777
fax: (970) 491-5091
email: kbestgen@colostate.edu

John Hayse
Environmental Science Division
Argonne National Laboratory
9700 S. Cass Ave.
Argonne, IL 60439
voice: (630) 252-7949
fax: (630) 252-6090
email: hayse@anl.gov

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<u>Category:</u>	<u>Expected Funding</u>
<u>Source:</u>	
<input type="checkbox"/> Ongoing project	<input type="checkbox"/> Annual funds
<input type="checkbox"/> Ongoing-revised project	<input type="checkbox"/> Capital funds
<input checked="" type="checkbox"/> Requested new project	<input type="checkbox"/> Other <i>[explain]</i>
<input type="checkbox"/> Unsolicited proposal	

Title of Proposal: **Historical assessment of factors affecting young Colorado pikeminnow abundance and physical habitat availability in the Green River, Utah.**

- I. Relationship to RIPRAP: Green River, I.D.1.e.(4) Integrate biological and physical data on backwaters.
- II. Study Background/Rationale and Hypotheses:

The Green River Study Plan recommends research to evaluate the effect of base flow variability on backwater habitat maintenance and quality. Responsive to that recommendation, this proposed study will begin as a synthesis of physical and biological information already collected in Reaches 2 and 3, including evaluating potential links between physical habitat data and abundance dynamics of age-0 Colorado pikeminnow.

This work will assist with evaluation of studies that aim to obtain a better understanding of how base flows and base flow variability affect backwater maintenance and quality in Reaches 2 and 3.

Western's annual studies of backwater topography in the Ouray reach are relevant to this evaluation and should be used to determine how base flow variability affects physical habitat characteristics (depth, volume, surface area). Integration of the backwater topography information with concurrent age-0 Colorado pikeminnow monitoring should be explored as a way to link biological information with backwater variability.

A Research Framework and life history conceptual model illustrated some of the many factors that influence abundance dynamics of early life history stages of Colorado pikeminnow (Bestgen et al. 2006, Research Framework draft report). Results of those and other studies (Bestgen et al. 2007) made several recommendations relevant to understanding recruitment dynamics of early life stages of Colorado pikeminnow including:

- 1) Investigate early life history abundance dynamics of Colorado pikeminnow with emphasis on interactions of habitat, environmental factors such as flow, and potential predator abundances and abundance of pikeminnow in drift and in backwaters and,
- 2) Investigate differences in hydrologic and biotic communities between reaches where age-0 Colorado pikeminnow remain sufficient to sustain juveniles (e.g. lower Colorado, lower Green River) compared to areas where age-0 Colorado pikeminnow may not be sufficient to sustain populations of juveniles (e.g., Colorado River in the Grand Valley, middle Green River).

Those recommendations are also consistent with uncertainties listed in the Green River Study Plan and will allow evaluation of hypotheses related to abundance dynamics of age-0 Colorado pikeminnow and other fishes such as:

- Effects of base flow level and variability (within-day, within-season, within-year, between years) on backwater quality in reaches 2 and 3,
- Effects of base flow level and variability on native and nonnative fish populations in Reach 2 and 3,
- Effects of base flows in summer and autumn scaled to spring hydrologic condition that may favor formation of backwaters in Reach 2, and
- Effects of maintenance of mean base flow within recommended levels of season and daily flow variability that may promote favorable backwater conditions in Reach 2.

III. Study Goals, Objectives, End Product:

Past studies have documented fish community dynamics in backwater habitats. However, there has been no comprehensive synthesis of available information to determine the relationship between fish communities and flows, water temperature patterns, and physical habitat availability. This study will synthesize physical and

biological information to better understand relationships between physical habitat and abundance dynamics of fishes, especially age-0 Colorado pikeminnow.

The motivation for this project is to understand reasons for the decline in abundance of age-0 Colorado pikeminnow in backwaters in the Green River. This study will investigate anticipated effects and uncertainties of the flow recommendations as identified in the Green River Study plan, including:

- Effect of base flow variability (within-day, within-season, within-year, between years) on backwater quality in reaches 2 and 3,
- The effect of base flows on nonnative fish populations in Reach 2,
- Base flows in summer and autumn scaled to hydrologic condition favor formation of backwaters in Reach 2, and
- Maintenance of mean base flow within recommended levels of season and daily flow variability will promote favorable backwater conditions in Reach 2.

A final report will integrate available information to determine relationships of changes in backwater fish communities (with emphasis on age-0 Colorado pikeminnow) to flow and temperature conditions that create and maintain backwaters.

IV. Study Area:

Green River downstream of Split Mountain Boat Ramp.

V. Study Methods/Approach:

The main emphasis of this project is to understand changes in backwater fish communities in reaches 2 and 3 since 1979. Two main sources of information will be backwater fish community data (e.g., ISMP data) and riverine and backwater physical data (e.g., stream flow and backwater topography data). The main motivations for this study are: 1) to better understand the decline of young of year Colorado pikeminnow since the mid 1990s and, 2) to continue evaluation of Flaming Gorge flow and temperature recommendations (Muth et al. 2000) as identified in the Green River Study Plan (<http://www.fws.gov/mountain-prairie/crrip/doc/FinalGRStudyPlan.pdf>).

Biological Data Investigations: Sampling in backwaters in the Green River in Reach 2 has documented a decline in abundance of YOY Colorado pikeminnow since the mid 1990's but reasons for declines are poorly understood. An analysis of available long-term biological data, combined with analysis of physical habitat, flow, and temperature data may aid understanding of population trends and mechanisms for declines.

Main data sources to be used include data collected by Colorado River Fisheries Program scientists beginning in 1979, ISMP data collected beginning in 1986, and additional information collected since about 2002 (e.g., projects 138, 144).

Backwater habitat data collected over time include estimates of YOY Colorado pikeminnow abundance (catch per unit effort), and associated species abundances. Those data will be examined to investigate whether changes in flow, temperature, and nonnative species abundance may be responsible for declining abundance of native fishes including Colorado pikeminnow. Metrics of flow and temperature characteristics to be examined include: changes in base flow level (within-day, within-season, within-year, between years), changes in base flow fluctuation with dam operational regimes, and seasonal and annual water temperature regimes.

Temporal changes in fish communities will also be examined to determine if changes in abundance of certain nonnative species may be responsible for or associated with declining Colorado pikeminnow abundance. Comparisons among reaches 2 and 3, where YOY Colorado pikeminnow abundance is low and high, respectively, will also be made.

Physical Habitat Data Investigations: An evaluation of backwater topography data (collected from 2003 to 2008) from Reach 2 will be completed. This analysis will determine if a relationship between backwater characteristics and peak flows is evident. In addition, those backwater data would be used to determine the effects of base flow level and fluctuations (magnitude, within-day, between-day, within-season) on backwater physical characteristics (depth, volume, and surface area). Changes in physical characteristics of these backwaters during periods when fish data were collected (1979 to present) will be estimated using the historical flow characteristics of those periods. These estimated changes in physical characteristics will be examined to determine if they can explain observed changes in Colorado pikeminnow abundance.

Other data that will be examined include backwater area data collected by Pucherelli et al. (1990); nursery habitat studies (e.g., Trammel and Chart 1999); backwater topography studies of Rakowski and Schmidt (1999); aerial photography data collected pre- and post-peak in 2005; and physical data collected during ISMP sampling. If a report from USGS sediment monitoring is available it may be incorporated into a final product.

Synthesis of information: A final report will integrate available information to determine relationships of changes in backwater fish communities (with emphasis on age-0 Colorado pikeminnow) to flow and temperature conditions that create and maintain backwaters. Anticipated outcomes of this project are hypotheses regarding fish community changes and exploration of factors responsible for such change. The final report will include recommendations for studies to address uncertainties and determine if changes in flow and temperature recommendations are warranted.

VI. Task Description and Schedule:

Task 1: Biological Data Investigations (June 2009 – September 2010)

- Gather, review, and summarize information in reports that describe the biological conditions and fish communities in backwaters of the Green River. (FY 2009)
- Obtain existing data sets from the authors of past reports that can be used to evaluate biological conditions in backwaters. (FY 2009)

- Gather historic hydrology and water temperature data from the USGS gages in the Green River that relate to ISMP and other data (FY 2009).
- Describe backwater fish communities (mostly ISMP data) and physical and biological factors that affect communities to understand temporal changes. (FY 2009 – FY 2010).

Task 2: Physical Habitat Data Investigations (June 2009 – September 2010)

- Gather, review, and summarize information in reports that describe the physical conditions in backwaters of the Green River. (FY 2009)
- Obtain existing data sets from the authors of past reports that can be used to evaluate physical backwater conditions. (FY 2009)
- Gather historic hydrology data files from the USGS gage at Jensen for years where ISMP data are available (FY 2009).
- Estimate physical backwater conditions during past years using topography models developed by Argonne and historic hydrographs for years that ISMP data are available. (FY 2009 – FY 2010).

Task 3: Synthesis (FY 2010 – FY2011)

- Develop and evaluate relationships between biological data and physical condition data for backwaters.
- Prepare draft synthesis report and deliver to Recovery Program Coordinator by September 30, 2010.
- Revise draft report to address coordinator comments and send to the Biology Committee and peer reviewers (November 30, 2010).
- Revise draft report to address comments from Biology Committee and peer reviewers. (Estimated final report delivery: January 15, 2011).

VII. Deliverables, Due Dates, and Budget by Fiscal Year:

FY 2009 Deliverables and Budget

- Annual project summary report (November 2009)

Budget FY 2009, Larval Fish Laboratory

Task 1, Biological data investigations

<u>Item</u>	<u>Days</u>	<u>Cost/day</u>	<u>Cost</u>
Labor			
Principal investigator	50	\$511	\$25,550
Biologist	15	\$250	3,750
Travel to Argonne			\$700
Software, computer	1	\$1800	\$1,800
		subtotal	\$31,800

Budget FY 2009, Argonne National Laboratory

Task 2, Physical habitat data investigations

<u>Item</u>	<u>Hours</u>	<u>Cost/hour</u>	<u>Cost</u>
Labor			
Principal investigator	40	\$173	\$6,920
Ecologist	160	\$130	\$20,800
Admin. support	20	\$117	\$2,340
		subtotal	\$30,060

FY 2010 Deliverables and Budget

- Draft synthesis report (September 30, 2010)

Budget FY 2010, Larval Fish Laboratory

Task 3, Biological data investigations, syntheses, and prepare draft report

<u>Item</u>	<u>Days</u>	<u>Cost/day</u>	<u>Cost</u>
Labor			
Principal investigator	50	\$526	\$26,300
Biologist	15	\$258	3,870
Travel			\$500
Miscellaneous			\$200
		subtotal	\$30,870

Budget FY 2010, Argonne National Laboratory

Task 3, Physical habitat data investigations, syntheses, and prepare draft report

<u>Item</u>	<u>Hours</u>	<u>Cost/Hour</u>	<u>Cost</u>
Labor			
Principal investigator	120	\$179	\$21,480
Ecologist	40	\$135	\$5,400
Admin. support	12	\$121	\$1,452
Editorial Support	16	\$106	\$1,696
		subtotal	\$30,028

FY 2011 Deliverables and Budget

- Final synthesis report (January 15, 2011)

Budget FY 2011, Larval Fish Laboratory

Task 3, Complete final report

<u>Item</u>	<u>Days</u>	<u>Cost/day</u>	<u>Cost</u>
Labor			
Principal investigator	15	\$542	\$8,130
Biologist	5	\$258	\$1,290
Travel			\$300
Miscellaneous			\$200
		subtotal	\$9,920

Budget FY 2011, Argonne National Laboratory

Task 3, Complete final report

<u>Item</u>	<u>Hours</u>	<u>Cost/Hour</u>	<u>Cost</u>
Labor			
Principal investigator	40	\$186	\$7,440
Admin. support	8	\$126	\$1,008
Editorial Support	8	\$109	\$872
		subtotal	\$9,320

Budget Summary:

<u>Budget Summary</u>	<u>LFL</u>	<u>Argonne</u>	<u>Total</u>
FY 2009	\$ 31,800	\$ 30,060	\$61,860
FY 2010	\$ 30,870	\$ 30,028	\$60,898
FY 2011	\$ 9,920	\$ 9,320	\$19,240
Subtotal:	\$ 72,590	\$ 69,408	\$141,998
Total project budget		\$141,998	

VIII. Reviewers:

IX. References:

Bestgen, K. R., D. W. Beyers, J. A. Rice, and G. B. Haines. 2006. Factors affecting recruitment of young Colorado pikeminnow: synthesis of predation experiments, field studies, and individual-based modeling. Transactions of the American Fisheries Society 135:1722–1742.

- Bestgen, K. R., J. A. Hawkins, G. C. White, K. Christopherson, M. Hudson, M. Fuller, D. C. Kitcheyan, R. Brunson, P. Badame, G. B. Haines, J. Jackson, C. D. Walford, and T. A. Sorensen. 2007. Population status of Colorado pikeminnow in the Green River Basin, Utah and Colorado. *Transactions of the American Fisheries Society* 136:1356-1380.
- Muth, R.T., L.W. Crist, K.E. LaGory, J.W. Hayse, K.R. Bestgen, T.P. Ryan, J.K. Lyons, R.A. Valdez. 2000. Flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.
- Pucherelli, M. J., R. C. Clark, and R. D. Williams. 1990. Mapping backwater habitat on the Green River as related to the operation of Flaming Gorge Dam using remote sensing and GIS. *U.S. Bureau of Reclamation* 90 (18):1–11.
- Rakowski, C. L., and J. C. Schmidt. 1999. The geomorphic basis of Colorado pikeminnow nursery habitat in the Green River near Ouray, Utah. Report A *in* Flaming Gorge Studies: Assessment of Colorado pikeminnow nursery habitat in the Green River. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.
- Trammell, M. A., and T. E. Chart. 1999. Colorado pikeminnow young-of-the year habitat use, Green River, Utah, 1992–1996. Report C *in* Flaming Gorge Studies: Assessment of Colorado pikeminnow nursery habitat in the Green River. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.
- U.S. Department of the Interior and Western Area Power Administration. 2005. Biological Assessment on the operation of Flaming Gorge Dam. U.S. Department of the Interior, Bureau of Reclamation, and Western Area Power Administration, Salt Lake City, Utah.