

FY-2012-2013 PROPOSED SCOPE OF WORK for:

Project #: 115

Monitoring effects of Flaming Gorge Dam releases on the Lodore and Whirlpool Canyon fish communities

Lead Agency: Larval Fish Laboratory, CSU; Bureau of Reclamation; U.S. Fish and Wildlife Service

Jointly Submitted by: Larval Fish Laboratory, CSU; Bureau of Reclamation; U.S. Fish and Wildlife Service

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Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other (explain)

I. Title of Proposal:

Monitoring Effects of Flaming Gorge Dam releases on the Lodore/Whirlpool fish community

II. Relationship to RIPRAP:

See RIPRAP at <http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-action-plan.html>

Green River Action Plan: Mainstem

II.D. Evaluate and revise as needed flow regimes to benefit endangered fish populations.

III. Study Background/Rationale and Hypotheses: In FY01, the Recovery Implementation Program (RIP) revised the RIP Recovery Action Plan to include evaluating and revising, as needed, flow recommendations for the endangered fish throughout the Upper Colorado River Basin. Flaming Gorge Flow and Temperature Recommendations (FGFTR; Muth et al. 2000) were approved by the RIP in FY01. A Record of Decision was written in 2005 and flow and temperature recommendations have been implemented.

An expectation of implementation of new flow and temperature recommendations was that native and endangered fishes will benefit via expanded distribution and abundance. It is also possible that new flow and temperature regimes for native endangered fishes may also enhance distribution and abundance of certain nonnative fishes. This is a major concern of managers of the Colorado River in Grand Canyon, where a large population of endangered humpback chub (*Gila cypha*) already exists. There, the decision to enhance the riverine thermal regime to benefit mainstem populations of humpback chub needs to be weighed against potential increases in populations of nonnative fish which may compete with or prey upon native fish, including chubs. Similarly, effects of full implementation of new flow and temperature regimes of the Green River downstream from Flaming Gorge Dam need to be evaluated to determine relative benefits to native and endangered fishes and other non-native elements of the fish community.

An increased emphasis was placed on non-native fish removal in this study beginning in 2005. Expanded populations of non-native fish predators have been detected since 2002 due in part, to warmer water temperatures and lower flows. The proposed non-native fish removal and native fish monitoring study is a logical extension of work conducted by Bestgen and Crist (2000), and more recent sampling in 2002 to 2006 (Bestgen et al. 2006, Bestgen et al. 2007). That recent work was conducted to evaluate changes in the fish community that occurred since 1996 in response to partial implementation of new flow recommendations and to expansion and removal of non-native predaceous fishes in the Green River. Aspects of the new flow and temperature recommendations that were realized since 1996 were relatively higher spring peak flows in 1997 and 1999 and low and warm flows in the summer season from 2002 to 2007, followed by relatively high flows from 2008-2010. A number of changes in the fish community were observed during recent sampling in 2002 to 2010. Those included an expanded population of smallmouth bass *Micropterus dolomieu* in Lodore and Whirlpool canyons, and reproduction by that species in Lodore Canyon, as well as in downstream Whirlpool Canyon. We also detected upstream expansion and increased abundance of red shiner *Cyprinella lutrensis* and channel catfish *Ictalurus punctatus* in several years. However, the higher and cooler water year in 2008 resulted in delayed spawning of smallmouth bass and small size going into winter.

We also made interesting observations of native fishes during the 2002-2010 sampling. Recent sampling and telemetry work (Kitcheyan and Montagne 2005) during that same time revealed increased use of Lodore Canyon in summer by Colorado pikeminnow *Ptychocheilus lucius*. In 2006 and 2010, we also detected reproduction by Colorado pikeminnow in Lodore Canyon. Seine sampling in lower Lodore Canyon in summer 2003 captured an early juvenile razorback sucker *Xyrauchen texanus* x white sucker *Catostomus commersonii* hybrid (29 mm TL), which

indicated attempted reproduction by razorback suckers there in spring or early summer 2003. We also detected continued presence of humpback chub *Gila cypha* in Whirlpool Canyon in 2002, 2003, and 2004, along with a relatively large population of roundtail chub *Gila robusta*, which has subsequently declined. We also captured (N = 16 scanned for PIT tags) or observed (N = 60) bonytail *Gila elegans* in autumn 2004 in the Green River from the Echo Park boat ramp to downstream about 11 km a short time after their stocking at Echo Park (Bestgen et al. 2008).

An ongoing understanding of shifts in distribution and abundance patterns of non-native predaceous fishes and native/endangered fishes associated with Flaming Gorge operations will provide managers with information necessary to assess effects of full implementation of new flow and temperature recommendations. Of particular interest are continued assessment of recent changes in distribution and abundance of predaceous species such as smallmouth bass and other native fishes. This adds information to a continued management process (along with other ongoing studies downstream) that addresses uncertainties in flow and temperature recommendations that may affect the fish community (Muth et al. 2000).

IV. Study Goals, Objectives, End Product:

Goal: Remove non-native fishes and determine if changes in Green River flow and thermal regimes are associated with changes in distribution and abundance patterns of native and nonnative fishes in Browns Park, Lodore and Whirlpool canyons, and Island-Rainbow Park.

Objective 1. Remove non-native fishes and determine if shifts in distribution and abundance of large-bodied fishes have occurred in Lodore Canyon and Whirlpool Canyon by comparing the results of shoreline electrofishing and trammel net surveys with the results of previous studies, particularly Bestgen and Crist (2000) and results of the 2002-2010 sampling.

Objective 2. Remove non-native fishes and determine if shifts in the distribution and abundance of small-bodied fishes have occurred in Brown's Park, Lodore and Whirlpool canyons, and Island-Rainbow Park by comparing results of low-velocity, nearshore seining with the results of previous studies, particularly Bestgen and Crist (2000) and results of the 2002 to 2010 sampling.

Objective 3. Determine if Colorado pikeminnow spawn in the Green River upstream from the Yampa River confluence by sampling with drift nets in lower Lodore Canyon, and by summer sampling to determine presence of ripe adults. Drift net sampling will be done only occasionally when Green River flows are low and warm (conditions when pikeminnow spawning might be expected) and will be done in conjunction with drift-net sampling in the Yampa River (project 22f).

Objective 4. Analyze hydrological records as recorded by the USGS at their gaging station (09234500) near Greendale, Utah, to compare differences in current and historical operations.

Objective 5. Analyze temperature records of the Green River through Browns Park, Lodore Canyon, and Whirlpool Canyon to compare differences in current and historical operations.

Objective 6. Continue to analyze past otolith samples and those collected in 2007-2010 to

understand smallmouth bass spawning periodicity to assist with flow-related management of that species.

Objective 7. Based on results of objectives 1–6, determine physical effects of new operations and subsequent effects on the fish community of the Green River downstream of Flaming Gorge Dam.

End Product: Removal of non-native fishes and an assessment of effects of non-native fish removal and effects of new flow and temperature regimes based on the fish community response.

V. Study area

In general, the fish community of the Green River will be sampled between the Swinging Bridge in Brown's Park and the lower end of Rainbow Park in Dinosaur National Monument. Additional northern pike sampling in upstream reaches will also be conducted but specific areas dependent on habitat availability. Specific reaches and gear include:

Boat, raft or seine sampling for small-bodied fishes and northern pike: Beginning upstream near Red Creek in Brown's Park and extending downstream through Island-Rainbow Park.

Raft-based electrofishing and trammel-netting: Lodore Canyon: Entire Canyon, which consists of four contiguous, 5-mile reaches and; Whirlpool Canyon: Entire Canyon, which consists of 2 contiguous, 5-mile reaches.

VI. Study Methods/Approach

Sampling methods will be patterned closely after those used in 2002 to 2010 sampling. Data will be collected in a manner that generates catch per unit effort (CPUE) metrics (fish/hour electrofishing, small-bodied fish/m² habitat seined, larval fish/m³ water, fish/hour trammel-netting) with associated variance estimates to enable within-study, and annual comparative statistical analyses. Additional sampling techniques (e.g., angling, hoop nets) will be used on an experimental basis. Flow data collected by USGS and temperature data (U. S. Fish and Wildlife Service) at several of its gauging stations on the Green and Yampa rivers will be used to address Objectives 4 and 5.

Three sampling trips will be conducted each year. Sampling will begin in early to mid-summer and ending in autumn. We envision two sampling trips using electrofishing and a third trip using primarily netting gear. Seine sampling will occur on all trips. The two electrofishing trips will be 5-days in length and utilize a 7-person crew; netting trips will have similar requirements.

Large-bodied fishes; Electrofishing: Two electrofishing rafts will simultaneously sample the left and right shoreline. Each two-person crew (one boat operator and one netter) will collect all fish. Each 5-mile reach will be sampled in segments, usually about 1-2 miles each. At the lower end of each section all fish will be enumerated as an adult or sub-adult (based on pre-

determined total length ranges per species) and electrofishing effort will be recorded. Rare fish (T&E species) will be weighed, measured, and PIT-tagged. Thus, mean CPUE/trip/reach will be generated from the section samples.

In addition to simple enumeration, all fish will be measured and weighed in two sections (both shorelines) of each reach on each trip to characterize size structure and length/weight relationships. Non-native fishes (except salmonids) will be removed.

Descriptive statistics will be used to describe CPUE, lengths, and weights of fish and appropriate comparisons with previously collected data will be made. These data have been reported at several presentations in the recent past.

Large-bodied fishes; Trammel netting: Multi-filament trammel nets (23m x 1.8m; 25-cm outer mesh; 2.5-cm inner mesh) will be set at locations in Lodore and Whirlpool canyons with a main goal of sampling chubs in the genus *Gila*. Trammel nets collect a variety of species, but have been used in other studies as a primary gear type to collect native chubs in canyon-bound reaches of the Green (Chart and Lentsch 1999) and Colorado Rivers (Chart and Lentsch 2000, Valdez and Ryel 1995, McAda 2000). Trammel nets will be fished during crepuscular and nighttime hours at sites in Lodore and Whirlpool canyons. Nets will be set in low velocity habitats and along eddy lines. The number of nets set will be contingent on habitat availability and accessibility. Nets will be checked every 2 hours.

All fish will be measured, weighed, and tagged as necessary. Dorsal and anal fin rays will be enumerated from all chubs collected. Any suspected humpback chub will be photographed, primarily for the purpose of acquainting other researchers with the chubs found in Whirlpool Canyon. Appropriate morphometric measurements (as identified in Douglas et al. 1998) will be collected. Descriptive statistics will be used to describe CPUE, lengths, and weights of fish and appropriate comparisons with data previously collected will be made.

Large-bodied fishes; other gear types: In addition to electrofishing and trammel netting, other sampling techniques such as angling and trap nets may be employed to evaluate their efficiency. Angling will also be used to supplement total numbers of adult Colorado pikeminnow collected and marked for movement and length/weight analyses.

Small-bodied fishes; Seining: The purpose of this sampling will be to track shifts in distribution and abundance of the small-bodied nonnative (red shiner, sand shiner, fathead minnow) and native (speckled dace) cyprinids, and YOY of all other species. We will sample mostly backwaters, eddies, and shorelines; other habitat types (e.g., riffles) will be sampled as needed to detect species of interest. Two or more seine hauls will be taken in each sampled habitat and each seine haul will represent a sample. Physical measurements including area seined and habitat area will be gathered to quantify habitat dimensions and calculate CPUE. Seines used in this study will conform with the ISMP-recommended gear type. Readily identified endangered species will be measured and released alive. Other fish will be preserved in 10% buffered formalin and processed at CSU/LFL.

We will also begin to conduct analyses to understand timing and intensity of smallmouth bass

reproduction in the Green River. This will be accomplished by analyzing otolith daily increments of smallmouth bass collected and preserved in ethanol during past years (2002-2010 as available). This will require analysis of several years of samples to understand effects of different flow and temperature regimes on timing and intensity of spawning. This analysis began in 2007 and results will be available as data are collected to understand the need for additional analyses. Presentations of these results have been prepared for annual meetings each year since 2008.

Northern pike habitat and fish sampling: This item was added at the request of the Program Director's office because northern pike reproduction was detected in autumn 2005 in Browns Park. The first facet of this investigation assessed habitat available for northern pike in Browns Park (from near Beaver Creek downstream of Flaming Gorge Dam downstream to Lodore boat ramp). We will continue to assess areas where northern pike are concentrated by sampling areas where age-0 pike have been captured in the past. In past years we concentrated on nearshore areas and will continue to assess nearshore and main channel habitat for presence of age-0 and adult northern pike. In 2006, we also captured smallmouth bass in Browns Park at two locations (Bestgen et al. 2007). Browns Park sampling would also be used to assess if smallmouth bass populations are expanding or remain isolated. Sampling through 2010 showed that smallmouth bass were sporadic but pike were persistent in Browns Park. Continued sampling in 2011 is ongoing to monitor if populations are expanding or maintaining at low levels. We think about a week of intensive sampling would be sufficient to survey most of the available areas. Timing of sampling would also be dependent on the above-referenced information. These data have been reported at several non-native fish workshop meetings in the last few years.

VII. Task Description and Schedule

- Task 1: remove non-native fishes and sample main-channel fish community (large-bodied fishes)
- Task 2: remove non-native fishes and sample small-bodied fish community, with pike sampling in Browns Park
- Task 3: process preserved samples of small-bodied fish and conduct otolith analyses (fish from seine samples)
- Task 4: prepare and submit annual report

Schedule: FY-2012 (Tasks 1-4)

Task	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	x								x	x	x	x
2								x	x	x	x	x
3	x	x	x	x	x	x					x	x
4	x	x										

Schedule: FY-2013

Task	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	x								x	x	x	x
2								x	x	x	x	x

3	x	x	x	x	x	x					x	x
4	x	x										

VIII. FY-2012 Work (Tasks 1-4): Sampling, sample processing, and annual reporting.
 – Deliverables/Due Dates: Annual Reports of field activities due to PD’s office November 2012 and November 2013.

– Budget: 2012

Larval Fish Lab and USBR Fish Community Monitoring Trip Costs and Reporting (Tasks 1-4): five trips total, one in each of June/July, August, and September (5-day trip plus two-days of gear and trip preparation per trip) plus the additional pike habitat and sampling assessment in Browns Park, to address: Task 1 (monitor large-bodied fish), Task 2 (monitor small-bodied fish with seines, plus pike sampling and habitat assessment) and Task 3 (process seine samples and conduct otolith analyses). An additional Task in 2012 is to summarize otolith data collected from 2003-2010, for Yampa and Green rivers, which is detailed separately from field sampling. We maintained salary costs again in 2012 and 2013, similar to 2010-2011 in spite of increases, which will have to be absorbed elsewhere. This is not sustainable and an increase will be sought in the future when budgets are not as restricted, or tasks will be reduced. Fringe benefits are 25% of the total amount of salaries. LFL overhead rate is 17.5% under USBR Cooperative Agreement and is charged to all items. Fringe and overhead are figured into the per day costs for LFL items.

Quantity (d)	Description	Unit cost/d	LFL	BR		Total
Personnel salaries						
21	Biologist (LFL), field sampling (tasks 1-3)	\$450	9450			9450
10	Biologist (LFL), report preparation (task 4)	\$450	4500			4500
112	4 LFL Technicians (4 trips x 7 trip days total x 4, tasks 1- 3)	\$190	21280			21280
15	1 LFL Technician, report preparation (task 4)	\$190	2850			2850
5	Biologist, USBR	\$ 420		2100		2100
Subtotal personnel			38080	0	0	40180
Trip expenses						
160 pers days	per diem	\$17/day	2,720			2720
LFL miles	900 x 4 trips = 3,600	0.37/mile	1,332			1332
	sampling (Whirlpaks®, preservatives, etc)		350			350
	camp/ sampling gear		600			600

	generator / boat gas/trailer		50			50
Subtotal supplies			5,052	0		5,052
Sample processing						
120	seine hauls (1 sample/haul) plus conduct otolith analysis of specimens from past and 2011 samples	\$75/sample	17,500			17500
Fish Community Monitoring trips			60,632			62,732
Equipment						
	Misc equipment (dipnets, measuring boards, electronic balances, etc	Various	259			800
1	Trammel nets	\$200	200			600
2	Seines	\$60	120			180
Subtotal equipment			579			1580
Fish Comm. Monitor. FY2012 Totals			61211	2,100	0	63,311

Otolith data summary, 2003-2010

Quantity (d)	Description	Unit cost/d	LFL	BR		Total
Personnel salaries						
29	Biologist (LFL), data analysis	\$450	13,050			13,050
9	Biologist (LFL), report preparation	\$450	4050			4050
10	Technician, report preparation	\$190	1900			1900
			19,000			19,000

USFWS, Vernal Fish Community Monitoring Trip Costs and Reporting (Tasks 1-2) : three trips total, one in each of June/July, August, and September (5-day trip plus two-days of gear and trip preparation per trip), to address: Task 1 (monitor large-bodied fish), Task 2 (monitor small-bodied fish with seines).

Task Activity	Cost
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Task 1-2 Sample Fish Population

Labor	
GS-11 Biologist (\$36.67/hr x 8 hrs/day x 5 days/trip x 3 trips) + (\$55.00/hr x 2 hrs OT/day x 5 days/trip x 3 trips)	\$6,050

GS-11 Biologist Trip Prep (\$36.67/hr x 8 hrs/day x 3 days)	\$880
GS-8 Fisheries Tech (\$28.29/hr x 8 hrs/day x 5 days/trip x 3 trips) + (\$42.44/hr x 2 hrs OT/day x 5 days/trip x 3 trips)	\$4,668
GS-8 Fisheries Tech Trip Prep (\$28.29/hr x 8 hrs/day x 6 days)	\$1,358
GS-5 Tech (\$20.56/hr x 8 hrs/day x 5 days/trip x 3 trips) + (\$30.84/hr x 2 hrs OT/day x 5 days/trip x 3 trips)	\$3,392
GS-5 Tech Trip Prep (\$20.56/hr x 8 hrs/day x 9.58 days)	\$1575
Subtotal	
	\$17,923
Travel, Boat gas, Equipment, etc.	
Shuttles 900, 2 trucks/trip x 173 mi/truck x \$0.405/mi x 3 trips, Vernal to Lodore & back	\$1320
(8 gal gas/boat x 2 boats/trip x \$2.50/gal x 3 trips)	\$120
(2 qts motor boat oil/boat x 2 boats/trip x \$2.75/qt x 3 trips)	\$33
Maintenance and replacement of rafting gear, sampling nets, electrofishing gear, etc.	\$1,693
Subtotal	
	\$3,166
Task 1-2 Total	
	\$21,089

FY2012 Budget Summary: condenses tables above

Description	LFL	BR	USFWS	Total
Fish Comm. Monitor. + report (Tasks 1-4)	80,211	2,100	21,089	103,400
FY2012 TOTAL	80,211	2,100	21,089	103,400

– Budget: 2013

Larval Fish Lab and USBR Fish Community Monitoring Trip Costs and Reporting (Tasks 1-4): four trips total, one in each of June/July, August, and September (5-day trip plus two-days of gear and trip preparation per trip) plus the additional pike habitat and sampling assessment in Browns Park, to address: Task 1 (monitor large-bodied fish), Task 2 (monitor small-bodied fish with seines, plus pike sampling and habitat assessment) and Task 3 (process seine samples and conduct otolith analyses). Fringe benefits are 25% of the total amount of salaries. LFL overhead rate is 17.5% under USBR Cooperative Agreement and is charged to all items. Fringe and overhead are figured into the per day costs for LFL items.

Quantity (d)	Description	Unit cost/d	LFL	BR	Total
Personnel salaries					
21	Biologist (LFL), field sampling (tasks 1-3)	\$450	9450		9450

10	Biologist (LFL), report preparation (task 4)	\$450	4500			4500
112	4 LFL Technicians (4 trips x 7 trip days total x 4, tasks 1- 3)	\$190	21280			21280
15	1 LFL Technician, report preparation (task 4)	\$190	2850			2850
5	Biologist, USBR	\$ 420		2100		2100
Subtotal personnel			38080	0	0	40180
Trip expenses						
160 pers days	per diem	\$17/day	2,720			2720
LFL miles	900 x 4 trips = 3,600	0.37/mile	1,332			1332
	sampling (Whirlpaks®, preservatives, etc)		350			350
	camp/ sampling gear		600			600
	generator / boat gas/trailer		50			50
Subtotal supplies			5,052	0		5,052
Sample processing						
120	seine hauls (1 sample/haul) plus conduct otolith analysis of specimens from past and 2012 samples	\$75/sample	17,500			17500
Fish Community Monitoring trips			60,632			62,732
Equipment						
	Misc equipment (dipnets, measuring boards, electronic balances, etc	Various	259			800
1	Trammel nets	\$200	200			600
2	Seines	\$60	120			180
Subtotal equipment			579			1580
Fish Comm. Monitor. FY2013 Totals			61211	2,100	0	63,311

USFWS, Vernal Fish Community Monitoring Trip Costs and Reporting (Tasks 1-2) : three trips total, one in each of June/July, August, and September (5-day trip plus two-days of gear and trip preparation per trip), to address: Task 1 (monitor large-bodied fish), Task 2 (monitor small-bodied fish with seines).

Task Activity	Cost
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Task 1-2 Sample Fish Population

	Labor	
GS-11 Biologist (\$36.67/hr x 8 hrs/day x 5 days/trip x 3 trips) + (\$55.00/hr x 2 hrs OT/day x 5 days/trip x 3 trips)		\$6,050
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GS-8 Fisheries Tech (\$28.29/hr x 8 hrs/day x 5 days/trip x 3 trips) + (\$42.44/hr x 2 hrs OT/day x 5 days/trip x 3 trips)		\$4,668
GS-8 Fisheries Tech Trip Prep (\$28.29/hr x 8 hrs/day x 6 days)		\$1,358
GS-5 Tech (\$20.56/hr x 8 hrs/day x 5 days/trip x 3 trips) + (\$30.84/hr x 2 hrs OT/day x 5 days/trip x 3 trips)		\$3,392
GS-5 Tech Trip Prep (\$20.56/hr x 8 hrs/day x 9.58 days)		\$1575
	Subtotal	\$17,923
	Travel, Boat gas, Equipment, etc.	
Shuttles 900, 2 trucks/trip x 173 mi/truck x \$0.405/mi x 3 trips, Vernal to Lodore & back		\$1320
(8 gal gas/boat x 2 boats/trip x \$2.50/gal x 3 trips)		\$120
(2 qts motor boat oil/boat x 2 boats/trip x \$2.75/qt x 3 trips)		\$33
Maintenance and replacement of rafting gear, sampling nets, elelctrofishing gear, etc.		\$1,693
	Subtotal	\$3,166
	Task 1-2 Total	\$21,089

FY2013 Budget Summary: condenses tables above

Description	LFL	BR	USFWS	Total
Fish Comm. Monitor. + report (Tasks 1-4)	61211	21 00	21089	84400
FY2013 TOTAL	61211	2,100	21089	84,400

– Deliverables/Due dates: Annual Report of FY2012 field activities due to PD’s office November 2012.

IX. Budget Summary

FY-2012 \$103,400
FY-2013 \$84,400
Total: \$187,800

X. Reviewers

Doug Osmundson, U.S. Fish and Wildlife Service, Grand Junction, CO
Kirk LaGory, Argonne National Laboratory, Argonne, IL
Rich Valdez, SWCA, Flagstaff, AZ

XI. References

- Bestgen, K.R. and L.W. Crist. 2000. Response of the Green River fish community to construction and re-regulation of Flaming Forge Dam, 1962–1996. Final Report of Colorado State University Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado
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