

**COLORADO RIVER RECOVERY PROGRAM  
FY-2014–2018 PROPOSED SCOPE OF WORK for:**

Project No.: 140

Evaluating effects of non-native predator fish removal on native fishes in the Yampa River

Reclamation Agreement number: 09-FG-40-2863  
Reclamation Agreement term: 1 Oct. 2008-: 30 Sept. 2014

Lead Agency: Larval Fish Laboratory  
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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: Evaluating effects of non-native predator removal on native fishes in the Yampa River, Colorado.

II. Relationship to RIPRAP:

Green River Action Plan: Yampa and Little Snake Rivers  
See RIPRAP at <http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-action-plan.html>

III.A.1. Implement Yampa Basin aquatic wildlife management plan to develop nonnative fish control programs in reaches of the Yampa River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continued as needed.

III. Study Background/Rationale and Hypotheses:

Control actions for several non-native fish predators have been implemented in several rivers of the upper Colorado River Basin but effects of those removals on restoration of

native fishes is poorly known and needs ongoing monitoring. Understanding the response of the native fish community to predator removal is needed to understand if removal programs are having the desired effect. Strong scientific inferences can be obtained only from studies conducted with a valid methodology. Some of the critical components of an experimental design to assess effects of non-native predator fish removal include estimating the level and precision of the nonnative removal effort, achieving a large treatment (removal) effect, quantifying the response by native fishes to fish removal, comparing results in treatment and reference (control) reaches, replicating those treatments and controls in space and time, and controlling for extraneous confounding variables. I include some discussion of those points below to serve as the basis and justification for a proposed study design.

The summary report completed in March 2007 recommended additional sampling in anticipation that larger scale removals and environmental effects such as higher water or lower temperatures may lower predator abundance in the study reach and elicit a native fish response (Bestgen et al. 2007) such as happened in 2008. We intend to continue broader scale sampling including expanded effort in Lily Park to document such changes. We also plan to continue to evaluate removal efficiency annually. This gives a greater understand of levels of removal each year with our single pass sampling, and also allows evaluation of temporal trends in abundance at several sites so changes in bass abundance can be assessed.

- IV. Study Goals, Objectives, End Product: The goal of this work is to reliably estimate the response of resident native fishes to a known, relatively large, and well-estimated level of predator removal.

Specific objectives necessary to achieve that goal for Yampa River fish removal evaluation studies follow.

1. Select treatment and reference areas for study.
2. Implement removal of smallmouth bass and northern pike in treatment reaches in spring (mostly conducted in Project 125).
3. Assess abundance of predators in treatment and reference reaches to determine removal effects.
4. Conduct additional removals of small smallmouth bass prior to summer and early autumn (mostly under project 125, but also some associated with evaluation sampling in this study).
5. Analyze smallmouth bass otolith micro-increments to understand timing and intensity of reproduction in the Yampa River.
6. Estimate response of native fishes in autumn in control and treatment reaches after spring-summer predator removal, including some emphasis on the Lily Park section of the Yampa River.

End Product: RIP annual reports submitted following the field seasons after sampling was conducted. We have also participated in the annual non-native fish workshops and presented data that was collected as recently as one month prior to the meeting. We completed a four-year data summary and evaluation (Bestgen et al. 2007) in March 2007. If another such effort is planned during this fiscal period (2014 or beyond), the budget will need to increase in that year.

V. Study area: Yampa River, Colorado

Treatment and reference reaches have been established in the Yampa River as a part of non-native predator removal studies. The upper study area consists of a 24 mile (RM 125-101) beginning upstream of Morgan Gulch and ending downstream of Little Yampa Canyon. The downstream 12-mile reach has been designated the removal reach, and the upstream 12-mile reach has been designated the reference reach. This reach was chosen because it is relatively accessible and the reference reach has a sampling history (R. Anderson, Colorado Division of Wildlife, this study) that will be valuable to assessing trends in fish abundance over time.

The other treatment area (no reference) is a 5-mile river reach in Lily Park. We plan to continue sampling in the Lily Park reach of the Yampa River, because it offers a substantially more intact native fish assemblage than the upstream reach and will give us insights into effects of removal in that setting. Sampling in that reach will also offer insights into longitudinal effects the river on the fish community, both for native and non-native species, which will allow us to put findings in the upstream reach into better perspective. This sampling is also consistent with nonnative fish predator removal efforts planned under associated project 125.

VI. Study Methods/Approach:

Study reaches were designated in spring 2003 following discussions with personnel from the Colorado Parks and Wildlife. This includes assignment of reference and treatment reaches. Removals will be implemented in spring from designated reaches during sampling designed to assess abundance and ultimately, remove, non-native predators. Additional sampling and removal will occur during sampling to estimate abundance of Colorado pikeminnow. Details of sampling and the history of sampling reach changes are summarized in Bestgen et al. (2007); those descriptions are still valid.

The plan at present is to mark predator fish on one or more passes in all reaches to assess their distribution, abundance, and size-structure. Removal efforts in treatment reaches will then commence and will add to the data available to estimate abundance of predator fishes in the reach. A minimum of 5 and often up to 9 or 10 removal passes is typically conducted; the number of marking and removal passes largely dependent on sampling success and water levels that will support extended sampling efforts. Additional removal

sampling conducted during the beginning of the smallmouth bass spawning season (Surge) with smaller craft (e.g., rafts) has been successful and will continue into the future.

Capture-recapture data collected in the sampling reaches will be used to generate estimates of abundance of non-native predator fishes following spring and early-summer sampling. These estimates will allow us to determine if we have achieved target levels of reduction for fish predators. Additional summer and early autumn removals of small-bodied bass will be conducted in the reach as well with electric seines, as has been done in the past.

**Small-bodied fishes evaluation.**—In each of the reference and treatment reaches, we will identify suitable low-velocity channel margin areas for sampling. Low-velocity shoreline areas and backwaters are typically the most sampled habitat types. We also choose areas that are typically available from year to year for sampling if similar areas can be found in each of the reference and treatment reaches, which allows for some documentation of annual changes in young bass abundance. An effort will also be made to choose sampling areas in treatment and reference reaches that are similar in size and habitat characteristics. We have sampled mostly with an electric seine in the past several years although a backpack shocker and conventional seine have been used when turbidity limits sampling efficiency. Samples of each species captured are measured and weighed so that comparisons of size structure could be made. Non-native predators captured in the treatment reach are removed, fish captured in reference areas are returned. We attempt to generate catch/effort estimates for all species captured, including non-native cyprinids, because these species may also show a response to removal of non-native fish predators in the reach. Sampling area and other aspects of the habitat would be quantified so that comparisons could be made between control and reference areas. Data available for comparison among treatment and reference areas would be fish community composition, density estimates based on effort or area sampled, and community size-structure. Large-bodied fish response data in the study area are collected during spring sampling in Project 125 in selected 1-mile reaches.

We will also continue to conduct analyses to understand timing and intensity of smallmouth bass reproduction in the Yampa River. This will be accomplished by analyzing otolith daily increments of smallmouth bass collected and preserved in ethanol during past years including 2012 and 2013. A key to this aspect of the study is to obtain data in several different hydrologic years with differing water temperatures to understand those effects on smallmouth bass life history, reproduction, and extensions to recruitment. We have also learned much about growth and recruitment patterns of smallmouth bass and incorporated this information into stock assessments and a population dynamics model that are ongoing (project 161). This information was valuable to describe smallmouth bass life history and this work should continue as we gather additional information with each type of runoff year and thermal regime.

VII. Task Description and Schedule

- Task 1. Prepare sampling equipment.
- Task 2. Small-bodied fish sampling.
- Task 3. Large-bodied fish sampling.
- Task 4. Data entry and analysis.
- Task 5. Otolith analysis.
- Task 6. Annual reporting.

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

Annual report /early November each year.

Travel: Travel costs for field work based on estimated per diem rates for Colorado State University for the area we are working in. Mileage is based on the standard rate for Motor Pool vehicles, which varies depending on age and size of the vehicle. We will use \$ 0.50 per mile for 2014. Meeting costs include three nites of hotel, per diem, and mileage to travel to meetings. These include costs for two people.

Personnel: Salaries include 27% fringe rate, an estimate for 2014, plus overhead. Overhead is calculated on all items (including salary plus fringe rate) at 17.5%, per our agreement with BOR.

Supplies: Supplies are used in the conduct of field sampling. Estimated costs based on current prices procured from various online sources (NRS rafting supplies, gas and oil, Mercury Outboard Corp. for motor props, Christiansen Inc, for net supplies, Fischer Scientific for preservatives).

Budget notes: We recognize the need to keep costs low, and have only minimally increased the budget for this project; budget was static from 2011-2013. Increases needed to support mandated raises for personnel.

**Larval Fish Laboratory, FY2014**

Task 1, Prepare sampling equipment

Item			Cost
Labor	Units	Cost/unit	
Principal investigator (d)	2	560	\$1,120
Senior technician (d)	7	226	\$1,582
Technician (d)	5	145	\$725
		subtotal	\$3,427

Travel

Per diem (d)	2	45		\$90
Mileage (miles)	150	0.5		\$75
			subtotal	\$165
			Total	\$3,592

Task 2 and 3, sample fishes

Item	Units	Cost/unit		Cost
<b>Labor</b>				
Principal investigator (d)	15	560		\$8,400
Senior technician (d)	80	226		\$18,080
Technician (d)	120	145		\$17,400
			subtotal	\$43,880
<b>Travel</b>				
Per diem (d)	140	25		\$3,500
Mileage (miles)	7500	0.5		\$3,750
Housing (monthly rental)	2.5	1000		\$2,500
			subtotal	\$9,750
<b>Supplies</b>				
gas (\$4/gal)	50	4		\$200
oil	5	2.5		\$13
props	1	200		\$200
nets, seines, pens	4	98		\$392
preservative	1	33		\$33
misc tools for repairs	10	22		\$220
raft gear (oars, flotation)	6	100		\$600
			subtotal	\$1,658
			Total	\$55,288

Task 4, data entry and analysis

Item	Units	Cost/unit		Cost
<b>Labor</b>				
Principal investigator (d)	7	560		\$3,920
Senior technician (d)	24	226		\$5,424

Technician (d)	10	145		\$1,450
			Total	\$10,794

Task 5, otolith analysis

Item	Units	Cost/unit		Cost
Labor				
Principal investigator (d)	7	560		\$3,920
Senior technician (d)	20	226		\$4,520
Technician (d)	25	145		\$3,625
			Total	\$12,065

Task 6, annual report preparation

Item	Units	Cost/unit		Cost
Labor				
Principal investigator (d)	5	560		\$2,800
Senior technician (d)	7	226		\$1,582
Technician (d)	5	145		\$725
			subtotal	\$5,107
Travel				
planning mtg	2	500		\$1,000
			subtotal	\$1,000
			Total	\$6,107
Total tasks 1-6				\$87,846

**Larval Fish Laboratory, FY2015**

Task 1, Prepare sampling equipment

Item	Units	Cost/unit		Cost
Labor				
Principal investigator (d)	2	576.8		\$1,154

Senior technician (d)	7	232.78	\$1,629
Technician (d)	5	149.35	\$747
			subtotal \$3,530
Travel			
Per diem (d)	2	45	\$90
Mileage (miles)	150	0.5	\$75
			subtotal \$165
			Total \$3,695

Task 2 and 3, sample fishes

Item	Units	Cost/unit	Cost
<b>Labor</b>			
Principal investigator (d)	15	576.8	\$8,652
Senior technician (d)	80	232.78	\$18,622
Technician (d)	120	149.35	\$17,922
			subtotal \$45,196
Travel			
Per diem (d)	140	25	\$3,500
Mileage (miles)	7500	0.5	\$3,750
Housing (monthly rental)	2.5	1000	\$2,500
			subtotal \$9,750
Supplies			
gas (\$4/gal)	50	4	\$200
oil	5	2.5	\$13
props	1	200	\$200
nets, seines, pens	4	98	\$392
preservative	1	33	\$33
misc tools for repairs	10	22	\$220
raft gear (oars, flotation)	6	100	\$600
			subtotal \$1,658
			Total \$56,604

Task 4, data entry and analysis

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	7	576.8	\$4,038
Senior technician (d)	24	232.78	\$5,587
Technician (d)	10	149.35	\$1,494
			Total \$11,118

Task 5, otolith analysis

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	7	576.8	\$4,038
Senior technician (d)	20	232.78	\$4,656
Technician (d)	25	149.35	\$3,734
			Total \$12,427

Task 6, annual report preparation

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	5	576.8	\$2,884
Senior technician (d)	7	232.78	\$1,629
Technician (d)	5	149.35	\$747
			subtotal \$5,260
Travel			
planning mtg	2	500	\$1,000
			subtotal \$1,000
			Total \$6,260
			Total tasks 1-6 \$90,104

**Larval Fish Laboratory, FY2016**

Task 1, Prepare sampling equipment

Item	Units	Cost/unit	Cost
<b>Labor</b>			
Principal investigator (d)	2	594.104	\$1,188
Senior technician (d)	7	239.7634	\$1,678
Technician (d)	5	153.8305	\$769
			subtotal \$3,636
<b>Travel</b>			
Per diem (d)	2	45	\$90
Mileage (miles)	150	0.5	\$75
			subtotal \$165
			Total \$3,801

Task 2 and 3, sample fishes

Item	Units	Cost/unit	Cost
<b>Labor</b>			
Principal investigator (d)	15	594.104	\$8,912
Senior technician (d)	80	239.7634	\$19,181
Technician (d)	120	153.8305	\$18,460
			subtotal \$46,552
<b>Travel</b>			
Per diem (d)	140	25	\$3,500
Mileage (miles)	7500	0.5	\$3,750
Housing (monthly rental)	2.5	1000	\$2,500
			subtotal \$9,750
<b>Supplies</b>			
gas (\$4/gal)	50	4	\$200
oil	5	2.5	\$13
props	1	200	\$200
nets, seines, pens	4	98	\$392
preservative	1	33	\$33
misc tools for repairs	10	22	\$220

raft gear (oars, flotation)	6	100		\$600
			subtotal	\$1,658
			Total	\$57,960

Task 4, data entry and analysis

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Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	7	594.104		\$4,159
Senior technician (d)	24	239.7634		\$5,754
Technician (d)	10	153.8305		\$1,538
			Total	\$11,451

Task 5, otolith analysis

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Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	7	594.104		\$4,159
Senior technician (d)	20	239.7634		\$4,795
Technician (d)	25	153.8305		\$3,846
			Total	\$12,800

Task 6, annual report preparation

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Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	5	594.104		\$2,971
Senior technician (d)	7	239.7634		\$1,678
Technician (d)	5	153.8305		\$769
			subtotal	\$5,418
Travel				
planning mtg	2	500		\$1,000
			subtotal	\$1,000
			Total	\$6,418
Total tasks 1-6				\$92,430

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**Larval Fish Laboratory, FY2017**

Task 1, Prepare sampling equipment

Item	Units	Cost/unit	Cost
<b>Labor</b>			
Principal investigator (d)	2	611.9271	\$1,224
Senior technician (d)	7	246.9563	\$1,729
Technician (d)	5	158.4454	\$792
			subtotal \$3,745
<b>Travel</b>			
Per diem (d)	2	45	\$90
Mileage (miles)	150	0.5	\$75
			subtotal \$165
			Total \$3,910

Task 2 and 3, sample fishes

Item	Units	Cost/unit	Cost
<b>Labor</b>			
Principal investigator (d)	15	611.9271	\$9,179
Senior technician (d)	80	246.9563	\$19,757
Technician (d)	120	158.4454	\$19,013
			subtotal \$47,949
<b>Travel</b>			
Per diem (d)	140	25	\$3,500
Mileage (miles)	7500	0.5	\$3,750
Housing (monthly rental)	2.5	1000	\$2,500
			subtotal \$9,750
<b>Supplies</b>			
gas (\$4/gal)	50	4	\$200

oil	5	2.5	\$13
props	1	200	\$200
nets, seines, pens	4	98	\$392
preservative	1	33	\$33
misc tools for repairs	10	22	\$220
raft gear (oars, flotation)	6	100	\$600
			subtotal \$1,658

Total \$59,356

Task 4, data entry and analysis

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	7	611.9271	\$4,283
Senior technician (d)	24	246.9563	\$5,927
Technician (d)	10	158.4454	\$1,584
			Total \$11,795

Task 5, otolith analysis

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	7	611.9271	\$4,283
Senior technician (d)	20	246.9563	\$4,939
Technician (d)	25	158.4454	\$3,961
			Total \$13,184

Task 6, annual report preparation

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	5	611.9271	\$3,060
Senior technician (d)	7	246.9563	\$1,729
Technician (d)	5	158.4454	\$792
			subtotal \$5,581
Travel			
planning mtg	2	500	\$1,000

subtotal \$1,000

Total \$6,581

Total tasks 1-6 \$94,825

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### Larval Fish Laboratory, FY2018

#### Task 1, Prepare sampling equipment

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Item			Cost
Labor	Units	Cost/unit	
Principal investigator (d)	2	630.2849	\$1,261
Senior technician (d)	7	254.365	\$1,781
Technician (d)	5	163.1988	\$816
			subtotal \$3,857
Travel			
Per diem (d)	2	45	\$90
Mileage (miles)	150	0.5	\$75
			subtotal \$165
			Total \$4,022

#### Task 2 and 3, sample fishes

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Item			Cost
Labor	Units	Cost/unit	
Principal investigator (d)	15	630.2849	\$9,454
Senior technician (d)	80	254.365	\$20,349
Technician (d)	120	163.1988	\$19,584
			subtotal \$49,387
Travel			
Per diem (d)	140	25	\$3,500

Mileage (miles)	7500	0.5	\$3,750
Housing (monthly rental)	2.5	1000	\$2,500
			subtotal \$9,750
Supplies			
gas (\$4/gal)	50	4	\$200
oil	5	2.5	\$13
props	1	200	\$200
nets, seines, pens	4	98	\$392
preservative	1	33	\$33
misc tools for repairs	10	22	\$220
raft gear (oars, flotation)	6	100	\$600
			subtotal \$1,658
			Total \$60,795

Task 4, data entry and analysis

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	7	630.2849	\$4,412
Senior technician (d)	24	254.365	\$6,105
Technician (d)	10	163.1988	\$1,632
			Total \$12,149

Task 5, otolith analysis

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	7	630.2849	\$4,412
Senior technician (d)	20	254.365	\$5,087
Technician (d)	25	163.1988	\$4,080
			Total \$13,579

Task 6, annual report preparation

Item	Units	Cost/unit	Cost
Labor			
Principal investigator (d)	5	630.2849	\$3,151

Senior technician (d)	7	254.365		\$1,781
Technician (d)	5	163.1988		\$816
			subtotal	\$5,748
Travel				
planning mtg	2	500		\$1,000
			subtotal	\$1,000
			Total	\$6,748
			Total tasks 1-6	\$97,293

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IX. Budget Summary [*Provide total AND break-out by funding target (e.g. station)*]\*

FY-2014 \$87,846  
FY-2015 \$90,104  
FY 2016 \$92,430  
FY 2017 \$94,825  
FY 2018 \$97,293  
Total: \$462,498

X. Reviewers: Pat Martinez, Angela Kantola

XI. References

Bundy, J. M., and K. R. Bestgen. 2001. Evaluation of the Interagency Standardized Monitoring Program Sampling Technique in Backwaters of the Colorado River in the Grand Valley, Colorado. Unpublished report to the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin. Larval Fish Laboratory Contribution 119.

Bestgen, K. R., C. D. Walford, and A. A. Hill. 2007. Native fish response to removal of non-native predator fish in the Yampa River, Colorado. 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 150.