COLORADO RIVER RECOVERY PROGRAM Project No.: 140
FY-2016–2020 (FY2016-2017 segment) PROPOSED SCOPE OF WORK for:

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

Reclamation Agreement number *[if applicable & known]*: R14AP00001
Reclamation Agreement term *[if applicable & known]*: Oct. 1, 2014 – Sep. 30, 2018

Lead Agency: Larval Fish Laboratory
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Category:
__ Ongoing project
X Ongoing-revised project
__ Requested new project
__ Unsolicited proposal

Expected Funding Source:
X 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 that may reduce predator abundance in the study reach and elicit a positive native fish response (Bestgen et al. 2007) such as happened in 2008 through 2011. Understanding causes of negative responses of native fish are also important, as occurred in lower flow years 2012-2014. We intend to continue broader scale sampling including efforts in Lily Park if such is possible. We also plan to continue to evaluate removal efficiency annually. This gives a greater understanding 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 as needed 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. Another such effort is planned, perhaps in 2017 pending availability of funds, so the budget will need to increase in that year (see below).

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 due 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 2016-2017. Meeting costs include three nights of hotel, per diem, and mileage to travel to meetings. These include costs for two people.

Personnel: Salaries include 25.4 % fringe rate, an estimate for 2016, 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. Cost for a summary report of data collected through 2016 in FY 2017 (task 7 in FY-2017 budget), as requested by Program, represents an 11% reduction over the original $62,100 estimate.

Budget FY 2016-2020

Larval Fish Laboratory, FY2016

Task 1, Prepare sampling equipment

Labor	Units	Cost/unit		Cost
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
Travel				
Per diem (d)	2	45		$90
Mileage (miles)	150	0.5		$75
			subtotal	$165
			Total	**$3,801**

Task 2 and 3, sample fishes

Labor	Units	Cost/unit		Cost
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
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	**$57,960**

Task 4, data entry and analysis

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

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

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**

Larval Fish Laboratory, FY2017

Task 1, Prepare sampling equipment

Item				Cost
Labor	Units	Cost/unit		
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
Travel				
Per diem (d)	2	45		$90
Mileage (miles)	150	0.5		$75
			subtotal	$165
			Total	$3,910

Task 2 and 3, sample fishes

Item				Cost
Labor	Units	Cost/unit		
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
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	$59,356

Task 4, data entry and analysis

Item				Cost
Labor	Units	Cost/unit		
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				Cost
Labor	Units	Cost/unit		
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				Cost
Labor	Units	Cost/unit		
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**

Task 7, Summary report, 2003-2016 data

(represents an 11% reduction over the original $62,100 estimate)

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	66	630.2849		$41,599
Senior technician (d)	38	254.365		$9,666
Technician (d)	22	163.1988		$3,590
			subtotal	$54,855
Travel				
Per diem (d)	2	45		$90
Mileage (miles)	650	0.5		$325
			subtotal	$415
			Total	**$55,270**

Larval Fish Laboratory, FY2018

Task 1, Prepare sampling equipment

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

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				Cost
Labor	Units	Cost/unit		
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				Cost
Labor	Units	Cost/unit		
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				Cost
Labor	Units	Cost/unit		
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**

Larval Fish Laboratory, FY2019

Task 1, Prepare sampling equipment

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	2	649.1935		$1,298
Senior technician (d)	7	261.9959		$1,834
Technician (d)	5	168.0947		$840
			subtotal	$3,973
Travel				
Per diem (d)	2	45		$90
Mileage (miles)	150	0.5		$75
			subtotal	$165
			Total	$4,138

Task 2 and 3, sample fishes

Item			Cost
Labor	Units	Cost/unit	

Principal investigator (d)	15	649.1935		$9,738
Senior technician (d)	80	261.9959		$20,960
Technician (d)	120	168.0947		$20,171
			subtotal	$50,869
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	$62,276

Task 4, data entry and analysis

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	7	649.1935		$4,544
Senior technician (d)	24	261.9959		$6,288
Technician (d)	10	168.0947		$1,681
			Total	$12,513

Task 5, otolith analysis

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	7	649.1935		$4,544
Senior technician (d)	20	261.9959		$5,240
Technician (d)	25	261.9959		$6,550
			Total	$16,334

Task 6, annual report preparation

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	5	649.1935		$3,246
Senior technician (d)	7	261.9959		$1,834
Technician (d)	5	168.0947		$840
			subtotal	$5,920
Travel				
planning mtg	2	500		$1,000
			subtotal	$1,000
			Total	$6,920
			Total tasks 1-6	**$102,182**

Larval Fish Laboratory, FY2020

Task 1, Prepare sampling equipment

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	2	668.6693		$1,337
Senior technician (d)	7	269.8558		$1,889
Technician (d)	5	173.1376		$866
			subtotal	$4,092
Travel				
Per diem (d)	2	45		$90
Mileage (miles)	150	0.5		$75
			subtotal	$165
			Total	$4,257

Task 2 and 3, sample fishes

Item	Cost

Labor	Units	Cost/unit		
Principal investigator (d)	15	668.6693		$10,030
Senior technician (d)	80	269.8558		$21,588
Technician (d)	120	173.1376		$20,777
			subtotal	$52,395
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	$63,803

Task 4, data entry and analysis

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	7	668.6693		$4,681
Senior technician (d)	24	269.8558		$6,477
Technician (d)	10	173.1376		$1,731
			Total	$12,889

Task 5, otolith analysis

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	7	668.6693		$4,681
Senior technician (d)	20	269.8558		$5,397
Technician (d)	25	269.8558		$6,746
			Total	$16,824

Task 6, annual report preparation

Item				Cost
Labor	Units	Cost/unit		
Principal investigator (d)	5	668.6693		$3,343
Senior technician (d)	7	269.8558		$1,889
Technician (d)	5	173.1376		$866
			subtotal	$6,098
Travel				
planning mtg	2	500		$1,000
			subtotal	$1,000
			Total	$7,098
			Total tasks 1-6	**$104,870**

IX. Budget Summary*

The upper budget table estimate for FY 2016-17 includes the data summary report in 2017. The lower table is the budget if the Program decides to not fund the report in 2017. The cost of the report was reduced 11% from the original estimate of $62,100.

With report in 2017

	LFL
FY16	$92,430
FY17	$150,095
total	$242,525

Without report in 2017

	LFL
FY16	$92,430
FY17	$94,825
total	$187,255

	LFL
FY16	$92,430
FY17	$150,095
FY18	$97,293
FY19	$102,182
FY20	$104,870
	$546,870

X. Reviewers: Kevin McAbee, June 2015;

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.